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FOREST SERVICE
BUREAU OF ENTOMOLOGY & PLANT QUARANTINE

REPORT
of the
1948
BLACK HILLS
INSECT CONTROL PROJECT

Approved September 10, 1948 by

Arthur L. Nelson

Arthur L. Nelson
Assistant Regional Forester
U. S. Forest Service
Denver, Colorado

Submitted August 30, 1948, by

Paul P. McCord

Paul P. McCord, Forester
U. S. Forest Service
Denver, Colorado

Noel D. Wygant

Dr. Noel D. Wygant
Entomologist in Charge
Forest Insect Laboratory
Bureau of Entomology & Plant
Quarantine
Fort Collins, Colorado

Calvin L. Massey

Dr. Calvin L. Massey
Entomologist
Forest Insect Laboratory
Bureau of Entomology & Plant
Quarantine
Fort Collins, Colorado

INDEX

	Page No.
ABSTRACT.	1
✓ HISTORY OF INFESTATION.	3
1895-1908 Epidemic	3
Recurring minor infestations	3
1946 Epidemic.	3
✓ 1947 FALL SURVEY AND FINDINGS	4
Life history of <u>Dendroctonus ponderosae</u> Hopk	4
Survey on Harney National Forest	4
Survey on Black Hills National Forest.	4
Emergency deficiency appropriation	6
✓ PREPARATORY PLANNING FOR CONTROL WORK	6
✓ Planning by Forest Service	6
✓ Planning by Bureau of Entomology and Plant Quarantine. .	7
Conference on treating materials and methods	7
✓ Amount of work to be accomplished by Project	8
Conference on organization and key personnel	8
✓ ORGANIZATION AND OPERATION OF PROJECT	8
First work under emergency deficiency appropriation. . .	8
✓ Project headquarters established	9
✓ Technical assistance from Bureau of Entomology and Plant Quarantine.	9
✓ Camp construction.	9
Sundance camp	9
Moon camp	10
Sioux Indian camp	10
Hardy camp.	10
Accommodations furnished.	10
✓ Project work started	10
Aerial reconnaissance.	11
✓ Project work completed	11
Custer State Park.	12
Homestake Mining Co.	12
National Park Service.	12
✓ SAFETY.	12
Protective clothing.	12
Lost time accidents.	13
✓ PROJECT ACCOMPLISHMENTS	14

	Page No.
✓ RECOMMENDATIONS.	15
Spotting methods.	15
Treating methods.	16
Equipment	17
Treating materials.	18
Future work	18

APPENDIX

✓ FINANCIAL STATEMENT.	A-1
✓ ORGANIZATION CHART	A-2
List of personnel detailed to Project	A-3
.	A-4
✓ SPOTTING INSTRUCTIONS.	A-5
✓ TREATING INSTRUCTIONS.	A-10
✓ SAFETY INSTRUCTIONS.	A-15
<i>Agreements - copies of</i> MEMORANDUM OF UNDERSTANDING WITH STATE OF SOUTH DAKOTA	A-24
MEMORANDUM OF UNDERSTANDING WITH NATIONAL PARK SERVICE	A-28
MEMORANDUM OF UNDERSTANDING WITH HOMESTAKE MINING COMPANY. . .	A-29
LABOR TURNOVER AND EFFECTIVE STRENGTH.	A-30
✓ LABOR SITUATION.	A-31
Wage Rates.	A-31
Employment procedures	A-32
Mess	A-32
INFORMATION, RULES, AND REGULATIONS CONCERNING EMPLOYMENT. . .	A-33
✓ TREATING EQUIPMENT	A-34
Geroter	A-34
Oberdorfer.	A-35
Manually operated pumps	A-35
Automotive mounted power equipment.	A-38
✓ INSECTICIDAL MIXTURES.	A-38
Costs	A-40
COMPARATIVE COSTS OF TREATING BY VARIOUS TYPES OF EQUIPMENT. .	A-41

	Page No.
✓ AUTOMOTIVE EQUIPMENT.	A-41
✓ TOPOGRAPHY.	A-43
WEATHER	A-43
RELATION OF PROJECT TO THE FORESTS.	A-44
✓ ACCURACY OF 1947 FALL SURVEY.	A-44
✓ TRAINING.	A-45
FORM 676-R-2.	A-46
MEAL AUTHORIZATION SHEET.	A-47
INSECT RECORD, Form 59-1-R-2.	A-48
CUMULATIVE WEEKLY REPORT FORM	A-49
✓ MAP SHOWING PROBABLE INFESTATION, 1947.	A-51
✓ MAP SHOWING AREAS TREATED, 1948 <i>no trees treated by areas</i>	A-52

ABSTRACT

The Black Hills beetle (Dendroctonus ponderosae Hopk.) has long been an important insect enemy of the ponderosa pine timber in the Black Hills of Wyoming and South Dakota. Periodic control measures have been required to keep it in check. In 1946 it was observed to be present in epidemic proportions, and surveys by the Bureau of Entomology and Plant Quarantine indicated the necessity for control measures. Funds available were not adequate to check the outbreak, and a survey made in the fall of 1947 indicated that a large-scale control program would be required to check the infestation if millions of feet of valuable timber were not to be killed.

An emergency deficiency appropriation was requested of Congress, and on March 5, 1948, President Truman signed a bill making available \$235,000 for control of the Black Hills beetle on the Black Hills and Harney National Forests.

The Bureau of Entomology and Plant Quarantine, through its Fort Collins, Colorado, Forest Insect Laboratory, had been studying improved methods of control. In anticipation of the emergency appropriation, the Forest Service had been making preliminary plans for conducting a large-scale control operation.

Experiments conducted by the Bureau of Entomology and Plant Quarantine indicated that the beetle could be controlled by treating standing trees with a mixture of either orthodichlorobenzene or benzene hexachloride in No. 2 burner fuel. This method had not heretofore been used on ponderosa pine on a project basis. At a meeting between representatives of the Forest Service and the Bureau of Entomology and Plant Quarantine on February 26, 1948, it was agreed to handle this Project on the basis of treating standing trees insofar as possible.

It was recognized that the factors of limited time, shortage of labor, high cost of labor, and the type of treating contemplated would require a high degree of mechanization in all phases of control work. All further planning and organization was done with that in mind.

Preliminary plans were approved, key personnel selected, and on March 22, 1948, the 1948 Black Hills Insect Control Project office was opened at Deadwood, South Dakota, under a Project Director who was responsible to the Division of Timber Management of the Forest Service Region 2 Office at Denver, Colorado. Technical assistance was provided by the Bureau of Entomology and Plant Quarantine.

Time for control work was short. The organization was perfected, and equipment and materials were procured as rapidly as possible. Spotting started early in April, and full scale treating began as soon as equipment was available and snow conditions permitted access to the woods. Weather conditions hampered operations to a certain extent. Labor was not plentiful but was adequate to Project needs.

Treating operations on the Project were completed on July 22, 1948. 45,949 trees were treated on an area of 177,000 acres. Of these, 42,440 had been treated by Forest Service crews at an average net cost of \$4.32 per tree. Under cooperative agreements with the Forest Service, which involved financial cooperation from Project funds, the State of South Dakota treated 1,506 trees, and the Homestake Mining Company treated 2,003 trees. A total of 3,477,000 board feet of timber was treated.

The safety record on the job is considered good, there being only 4 lost-time accidents.

HISTORY OF THE INFESTATION

For the past 50 years the Black Hills beetle (Dendroctonus ponderosae Hopk.) has been the most important insect enemy of ponderosa pine in the Black Hills of Wyoming and South Dakota. The first major epidemic on which observations were made occurred in this area from 1895 to 1908. It was from this locality that the beetle acquired its name. During this epidemic between 1 and 2 billion board feet of ponderosa pine timber was killed. That infestation differed from the present one in that the trees killed were large and overmature. The trees killed in the present infestation were, for the most part, less than 100 years old and averaged around 70 feet board measure in volume.

Local infestations have occurred from time to time on various portions of the Black Hills and were controlled by Forest personnel. For example, 1,085 trees were treated on the Bearlodge Ranger District in 1931. Infestations of a like nature which occurred throughout the 1930's and up to 1942 were controlled by CCC crews. During the war years, control work on the beetle was curtailed.

While the presence of an infestation was known to Forest Officers, it was not until the fall of 1946 that a heavy infestation was detected. It was determined, at that time, that a serious infestation existed on the south end of the Bearlodge Ranger District, approximately 3 miles north of Sundance, Wyoming. Based on an ocular estimate, this area contained about 2,000 newly infested trees in 3 groups. In some cases the ratio of increase during 1946 was as high as 10 - 1.

In the fall of 1946, also, serious infestations were found on the Rochford Ranger District on the Silver Creek and Horsethief drainages. These areas were estimated to contain 3,000 trees and to show an infestation increase of 3 - 1.

The Bureau of Entomology and Plant Quarantine and the Forest Service made a more thorough survey during the latter part of January, 1947. The infested area in the Bearlodge Ranger District was determined to be 3,950 acres containing an estimated 6,070 infested trees with groups ranging in size from 6 to 2,000. On the Rochford Ranger District the Silver Creek infestation was determined to be 2,170 acres containing an estimated 2,547 infested trees. The Horsethief infestation was serious on a relatively small area.

During the fall of 1946 and spring of 1947, 5,425 trees were treated on the Black Hills National Forest. The Harney National Forest treated 1,899 trees.

Control work accomplished on the 1947-1948 infestation prior to March 7, 1948 (the date when the Project began operation) was 5,702 trees on the Black Hills and 2,803 trees on the Harney National

Forest. The figure for the Black Hills National Forest includes trees treated on National Forest land by the Homestake Mining Company after March 6, since this work was done under a cooperative agreement executed before the Project began and is not included in Project accomplishments.

During the latter part of July, 1947, an effort was made to control the beetle on approximately 190 acres involving about 1,200 infested trees by the aerial application of DDT and benzene hexachloride. The DDT was applied at the rate of 5, $7\frac{1}{2}$, and 10 pounds per acre on 3 separate plots. The benzene hexachloride was applied at the rate of 1 and 2 pounds of the gamma isomer per acre. The results of this experiment were unsatisfactory with all dosages and both insecticides.

1947 FALL SURVEY AND FINDINGS

Proper timing of survey and control measures is quite dependent on a knowledge of the life history of the insect to be controlled. That of Dendroctonus ponderosae Hopk. is well known through studies of the Forest Insect Laboratory of the Bureau of Entomology and Plant Quarantine.

The flight of the adult beetle usually starts late in July and continues during August. Upon emerging from infested trees, the beetle flies to nearby green trees and immediately attacks them. The insect passes the winter in the larval stage and pupation takes place during June. It transforms to the adult stage by the middle of July and emerges as soon as sexual maturity is attained. An entire year is required to complete the life cycle.

Trees infested by the insect exhibit the characteristic pitch tubes and boring dust soon after attack. The needles normally remain in a green condition until the latter part of May and the first part of June, at which time they usually turn a pale green or a light straw color. Such trees are referred to as "faders."

Survey work in the fall of 1947 was conducted along different lines on the 2 Forests involved. On the Harney National Forest, where the infestation was known to be much smaller, there was no systematic survey -- merely an ocular estimate by local forces on the basis of known infestations. This indicated a total of 7,700 infested trees.

On the Black Hills, where there were known to be widespread infestations, a more systematic survey was made beginning about September 15, 1947. Paul L. Ginter was detailed to make this survey, and the following is quoted from his report:

"Insect Survey Report on Black Hills Beetle in Ponderosa Pine on the Black Hills National Forest

"Methods of Survey

"Because of the large area involved, it was decided in conference between members of the Forest Service and representatives of the Bureau of Entomology and Plant Quarantine to have systematic

flights made over the Forest by the District Rangers or others familiar with the area, and to prepare a map of the Forest, showing the location of red tops.

"The following procedure was outlined and followed:

- "1. Each Ranger flew his District and spotted all red tops on a map.
- "2. Ground crews were organized on each District, and tenth-acre sample plots every 2 chains were taken along compass lines at 10-chain intervals. These strips of plots were made only in the areas showing heavy grouping or concentration of red tops. Strips of plots were run on cardinal directions whenever practicable. Each man worked independently after thorough training in pacing and use of compass. Length and number of strips were sufficient to cover the perimeter of red top concentration. Thus, a 5 percent survey was made of small areas.
- "3. To expedite the work, surveys were confined to heavily infested areas, and no cruising was done where red tops occurred singly or in scattered groups of 2 or 3, totaling less than 20 per square mile.
- "4. Occasional strips of plots were run diagonally through scattered areas of infestation.
- "5. Numbers of red tops and new attacks were recorded separately for each plot.
- "6. Later in the season to further expedite the survey, alternate areas were sampled on a 5 percent basis. This resulted in actually less than a $2\frac{1}{2}$ percent survey.
- "7. Numbers of newly attacked trees on each District determined by the survey were increased by 5 percent to include small scattered groups which were not sampled.
- "8. Two methods of determining the number of newly attacked trees were used:
 - "a. On the Limestone District the number of red tops excluding singles and scattered groups of 3 or less were counted and multiplied by the ratio of red tops to new attacks.
 - "b. On the other Districts the number of newly attacked trees as determined by the 5 percent survey was multiplied by 20 to obtain the total for the District. On a few small areas covered by a $2\frac{1}{2}$ percent survey the multiplier was 40."

The following tables are also quoted from Ginter's report:

Summary of Survey

<u>District</u>	<u>No. tenth A. plots</u>	<u>New attacks</u>	<u>1946 attacks</u>	<u>Ratio of 1947 to 1946 attacks</u>
Bearlodge	2,437	421	179	2.4 to 1
Spearfish	2,607	380	267	1.4 to 1
Limestone	3,222	450	365	1.2 to 1
Rochford	2,532	63	112	0.6 to 1
Pactola	879	20	39	0.5 to 1
Nemo	1,810	13	13	1 to 1

Summary of Total Infestation

<u>District</u>	<u>Acres needing treatment</u>	<u>No. infested trees</u>
Bearlodge	14,200	7,000
Spearfish	7,000	9,000
Limestone	14,400	20,000
Rochford	7,700	2,550
Pactola	1,500	440
Nemo	3,600	260
Total	48,400	39,250

These surveys did not include an estimate of infested trees on Custer State Park, on lands owned by the Homestake Mining Company, or on other private lands outside the National Forest boundaries.

The infestation thus indicated was of such magnitude that the immediate and effective control measures required could not be financed from limited regular funds available. It was estimated that \$235,000 would be needed for control work on the Black Hills and Harney National Forests. An emergency deficiency appropriation in this amount was requested and received from Congress. On March 5, 1948, President Truman's signature on the appropriation bill gave the signal to proceed with the 1948 Black Hills Insect Control Project.

PREPARATORY PLANNING FOR CONTROL WORK

In anticipation of the availability of funds for control work indicated as necessary by the 1947 fall survey, the Forest Service and the Bureau of Entomology and Plant Quarantine did considerable planning and investigative work during the winter of 1947-48.

The Forest Service did advance planning regarding the organization to accomplish the job, location, and size of camps, and availability of equipment to conduct the work. When it became apparent that the emergency deficiency appropriation bill stood a good chance of enactment, Paul P. McCord was selected to prepare preliminary plans and start initial action so that when funds were made available, the control work could begin with a minimum amount of delay.

After studying the situation, it was decided to handle control work on the 2 Forests involved on a Project basis under the leadership of a Project Director responsible to the Division of Timber Management of the Forest Service Region 2 Office at Denver.

In the meantime, the Forest Insect Laboratory of the Bureau of Entomology and Plant Quarantine at Fort Collins, Colorado, had been working on improved control methods. Because of the increased cost of labor and materials, it was necessary to develop a more economical method of controlling the Black Hills beetle. Working toward this end, the Forest Insect Laboratory intensified its experiments in controlling infestations by applying the insecticide to standing trees with power and hand pressure equipment.

To treat standing trees, it was necessary to develop equipment which would deliver a solid stream of insecticidal material to a height of approximately 35 feet at approximately 2 gallons per minute.

Three types of equipment, developed from commercial products, proved satisfactory:

1. Portable power equipment.
2. Portable hand operated equipment.
3. Automotive mounted power equipment.

Considerable time was also spent in the development of nozzles for use on portable equipment that would satisfactorily deliver a solid stream to the desired height. 2 types were developed from long distance nozzle blanks received from a commercial firm. Both were used extensively in treating operations.

Several insecticides were tested experimentally against the insects in standing trees. Since results obtained by the use of emulsions of DDT and benzene hexachloride in the spring of 1947 were not satisfactory, it was necessary to find other insecticides. Oil solutions of orthodichlorobenzene, chlorodane, and benzene hexachloride were tested against the beetle in standing trees during the fall of 1947. The mortality obtained with each of the materials was satisfactory. Chlorodane was not used because of its higher cost.

On February 26, 1948, a meeting was held between representatives of the Forest Service and the Bureau of Entomology and Plant Quarantine to decide on treating methods, materials, and equipment.

Based on experimental work, it was agreed that all trees that could be reached with the treating equipment would be treated standing with a mixture of orthodichlorobenzene or benzene hexachloride in No. 2 burner fuel. In order to give benzene hexachloride a thorough field test, it was agreed that approximately 25 percent of all trees would be treated with this chemical.

It was also agreed that Bean Agricultural type power sprayers, Bean Fog type power sprayers and Dobbins hand pumps would be used on the Project.

In planning Project organization, an important factor was the number and location of infested trees. Some treating had been done by both Forests prior to the beginning of the Project, which reduced the amount of work to be done. Also, the summary by Ranger Districts, prepared by Ginter, had to be revised by "work areas" for Project planning. Through conferences with personnel of the 2 Forests, the following resummation of work to be accomplished by the 1948 Black Hills Insect Control Project was determined:

<u>Work Area</u>	<u>Number of infested trees</u>
Sundance	13,000
Hardy	10,000
Spearfish	2,300
Black Hills-other	2,500
Moon	12,000
Harney-other	1,000
Total	40,800

The above estimates did not include Custer State Park, holdings of the Homestake Mining Company, or private holdings outside the National Forest boundaries. The original boundaries of the "work areas" and the location of infestation, as indicated by the survey, are shown on "Map Showing Probable Infestations" in the Appendix.

On March 12, 1948, a meeting was held at Denver between representatives of the Forest Service and the Bureau of Entomology and Plant Quarantine. Present was Mr. L. S. Gross of the Forest Service Washington Office Division of Timber Management.

It was agreed at this time to handle the control work as a Regional Office project under the Division of Timber Management with a Project Director in charge. Key personnel was selected, final decisions made regarding purchase of treating and automotive equipment, and arrangements made to supply the Project with materials for camp construction and small tools.

ORGANIZATION AND OPERATION OF PROJECT

First work under the emergency deficiency appropriation was done on the Harney National Forest beginning the week of March 7, 1948. The Harney - "other work area" was readily accessible to regular Forest crews operating out of Custer, and the Harney Forest Supervisor was authorized by the Regional Forester to proceed with control work up to a total of \$10,000. Two Bean fog pumps were mounted on jeep 1-ton trucks and used for treating. Back pack fire pumps were used for treating trees not accessible to the jeep trucks.

On March 22, 1948, Project Headquarters were established in space made available by the Forest Supervisor at Deadwood, South Dakota. Office furniture and equipment were obtained from Forest Service Regional stock.

A satisfactory warehouse and equipment yard was leased at Deadwood. Automotive repair and servicing facilities were made available in the Deadwood Forest Service Garage. Arrangements were made with the Harney Forest Supervisor for having heavy repairs made at the Hill City Shop.

The Project office organization followed the pattern of a Forest Supervisor's office: Project Director, Assistant Project Director, Administrative Assistant, Clerk, and Stenographer. (See appendix for organization chart.)

Dr. C. L. Massey of the Bureau of Entomology and Plant Quarantine was assigned to the Project and furnished technical advice and assistance throughout its life. This included assistance in the development of instructions and in giving training for both spotting and treating, inspection of all technical phases of control work, reconnaissance to locate infested areas, and the decision to cease treating operations.

There were immediately many fiscal problems to be met and solved. The decision to include quarters and subsistence as a part of the basic daily wages rather than by payroll deductions necessitated adjustment in the regular Form 676. Contracts had to be prepared for camp sites. Bids were called for and contracts let for mess and many other items. Applicants for work were lined up in the hall each morning and had to be interviewed and names recorded.

Camp construction at 3 different camps was started almost immediately, and the procurement of materials for this purpose presented many problems.

The Sundance Camp was the first to be completed. It was located on the Crook County, Wyoming, Fair Grounds at Sundance through leasing arrangements with the Crook County Commissioners. Included in the lease was the use of the display building. The large room of this building was used for a mess hall and the remainder for sleeping quarters. Old CCC buildings were moved in for additional barracks, office, and quarters for supervisory personnel, latrine, wash house, repair and supply buildings. A gas tank and pump were installed. Telephone service was obtained by an extension from the nearby Sundance Ranger Station. Water and electrical energy was available at the fair grounds and use was covered by the usual contracts. Mess was contracted with a local cafe proprietor. This camp was occupied on April 1 and closed on June 8. It was left intact except for storing all Government property other than wash house facilities in the barracks building and removing the gas tank and pump. No Project property was stored there.

The Moon camp was located in the Moon Hunting Lodge on the Harney National Forest through lease. The lodge served as barracks and office. Mess was contracted with Mrs. Hoyle, the hunting lodge proprietress, who served meals in the hunting lodge dining room. A combination wash house and storage building was provided by moving in an old CCC building. There is no water at this site, and a stock tank was erected on a tower and filled by pumping from water tanks hauled on a stake truck. The hunting lodge gas tank and pump were used exclusively for Project gas storage and issue. Electricity was furnished by a 5 KW Forest Service light plant. Telephone service was available at the hunting lodge but was unsatisfactory. The camp was left intact except for the removal of all Government property other than wash house facilities.

At Antelope Spring, about 3 miles from Moon Camp, a latrine and wash house was erected for a Sioux Indian Camp. The Indians erected their own sleeping tents and handled their own mess. This camp operated under the Moon Camp Superintendent.

The Hardy Camp was located a short distance from Hardy Ranger Station on the Black Hills National Forest. It was the most difficult and expensive camp to construct. Located on the crest of the Limestone ridge, weather conditions remained severe late in the spring and snow and mud slowed construction. Use was made of the old Ranger Station for quarters for the mess contractor and his employees. Two small bunk houses were used for office and tool storage and overhead quarters. In addition, 2 CCC buildings were moved from the Este CCC camp for mess hall and barracks. An additional barracks building was made available by the erection of a metal portable building purchased by the Project. Another old CCC building was erected for latrine and wash house. Telephone service was available through an extension from the Hardy Ranger Station. Electricity was provided by a 10 KW Forest Service light plant. The Ranger Station well furnished water, but the Project had to install a larger pump and motor to keep the reservoirs filled. The old Ranger Station water system was utilized by extending the pipeline to the wash house and kitchen. A gas tank and pump were installed at Hardy Ranger Station. The mess was contracted with a Deadwood cafe proprietor and was highly successful. The camp was occupied on May 12 and closed on July 22. It was left intact except for the removal of the light plant and the water pump. All Project property and supplies were stored there with the exception of some of the orthodichlorobenzene mixture.

Cots, blankets, sheets, pillows, and pillow cases were furnished to the men at all camps. Laundry was done at Project expense through contract with a local laundry.

Both treating and automotive equipment was slow to arrive, and parts for adapting equipment to Project needs were difficult to obtain.

Spotting was started in Sundance, Moon, and Hardy work areas in April as soon as roads were passable. Power equipment was used to open roads where necessary. Snowshoes were loaned by various Forests throughout Region 2 for use by spotting crews.

Late in April treating operations were started and by the middle of May were well under way.

Infested areas were located from information obtained from the 1947 fall survey and directly from District Rangers.

It had been expected early in the Project that effective aerial reconnaissance could be made by May 15 to pick up areas of infestation not indicated by the 1947 fall survey and to determine which areas of scattered infestation should be treated. Spotting work was arbitrarily limited to areas in which spotting crews could find and spot an average of 10 trees per man day because it was agreed that time and funds might be insufficient to complete the job if areas of lower intensity of infestation were treated before known areas of heavy infestation. However, fading of currently infested trees was delayed by a late spring, and it was not until about June 10 that fading had advanced to the point where aerial reconnaissance could be effective. On that date the first planned flight had to be abandoned because of poor visibility as the result of rainy weather. It was not until almost the end of June and the first part of July that weather conditions and available time on the part of personnel familiar with the terrain permitted reconnaissance flights. These flights were still valuable in locating infestations which had not been known before, but the delay and erratic manner in which fading occurred resulted in a last-minute volume of work which was much larger than anticipated. This resulted in some scattered trees and small groups not being treated.

Spotting in advance of treating continued as long as infestation occurred in sizable groups. During much of the work in July, spotting was accomplished by one or more spotters accompanying each treating crew and finding and spotting infested trees immediately in advance of treating.

As the Sundance and Moon camps were closed, crews were moved to the Hardy Camp, and untreated infestations in their respective "work areas" were added to the Hardy "work area." The Hardy Camp was the most comfortable camp of the 3, and the mess there was excellent. This was an important factor in holding crews together until the end of the Project; however, early in July many of the men accepted other employment, and retention of labor was a serious factor. On July 21 the labor situation, in combination with the rate of emergence of adult beetles, resulted in the decision to stop all treating operations at the close of work on July 22.

Had the 1947 fall survey been of sufficient intensity to accurately locate all infestations, or if effective aerial reconnaissance had been possible at an earlier date, it would have been possible to effectively treat nearly all infested trees. However, it is felt that all but very small concentrations and most areas of scattered infestation were covered and treated.

Control work on the Custer State Park was handled under a cooperative agreement with the South Dakota State Forester. A copy of this agreement is in the appendix of this report. The State Park officials seemed feel they had been successful in treating all infested trees.

The Homestake Mining Company treated infested trees on its lands with the exception of 300 which were treated near the end of the season by Project crews. Assistance was given them under the terms of an informal understanding (see McCord's "S - COOPERATION - Black Hills I. C. Project - Golden Gate Timber Co." memorandum, dated May 8, 1948, in the appendix).

Infested trees on Jewel Cave National Monument and Wind Cave National Park were spotted by the National Park Service and treated by the Forest Service under a Memorandum of Understanding between these 2 agencies, dated April 8, 1948 (see appendix). No control work was found to be necessary on the Rushmore National Memorial.

SAFETY

It was recognized that safety would have to be given special attention on this Project since it would involve the use of new materials of a toxic nature, unfamiliar types of equipment, and old types of equipment adapted to new uses. In addition, there would be present all of the old familiar hazards connected with woods work and operating automotive equipment.

The interest of all personnel was enlisted in developing and making effective a safety program especially tailored to the needs of this Project. The Assistant Project Director was given the specific assignment of safety assistant for the Project, and each camp superintendent appointed either his chief spotting foreman or chief treating foreman as safety assistant for his camp.

Special safety bulletins were prepared covering various phases of the Project operations, and safety talks were given daily in the field and frequently in the evenings.

Much thought was given to the possible harmful effects of insecticidal mixtures on human beings, and various types of protective clothing were studied and given field tests. Some individuals were found to be extra sensitive to the insecticidal material and had to be changed to other work or laid off. For the most part, however, it was found that harmful effects were not as serious as anticipated. The only protective clothing needed were neoprene impregnated gloves, goggles, and neoprene boots. Neoprene aprons were too hot and confining. In warm weather their use resulted in extra irritation by causing the skin pores to open, making the workers unusually sensitive to the chemicals, and very few workers could use them. Helmets with plastic shields were discarded for the same reason plus the fact that the shield quickly became covered with a film of oil, and visibility was lowered to the point where the worker raised the shield. Goggles

that can be placed over the eyes when insecticidal mixture mist is blown on the nozzle man and raised to his forehead at other times seemed to be the most suitable protection to the eyes. Boric acid, used as an eye wash, alleviated all eye irritations. The men handling insecticidal material were urged to bathe daily, and plenty of hot water was supplied at the showers for that purpose. Neoprene boots were found to be desirable, since ordinary shoes are quickly ruined by the insecticidal mixture, causing the men extra personal expense and dissatisfaction.

Hand axes were provided for spotting instead of a double bit axe, thereby reducing hazard from that source.

There were only 4 lost time accidents throughout the entire life of the Project. Two of these were charged to 1 mechanic whose services were otherwise unsatisfactory and whose employment was terminated. Both of these accidents were caused by his own negligence, and one of them especially was caused by his lack of mechanical ability.

PROJECT ACCOMPLISHMENTS
FROM MARCH 7 TO JULY 22, 1948

Treating Crews and Areas Treated°	No. of trees			Vol. of trees			Expenditures		
	trees treated	Acres treated	M ft. b.m.	Forest Control (1)	Pest Control		Total		
					Non-Federal				
Treated by Forest Service Crews									
National Forest Lands									
Black Hills National Forest	30,136	2,110	43,000	130,437.05		---		130,437.05	
Harney National Forest	9,897	700	50,000	42,837.08		---		42,837.08	
Total National Forest Lands	40,033	2,810	93,000	173,274.13(2)		---		173,274.13(2)	
National Park Lands	72	10	10,000	54.00(3)		---		54.00(3)	
Homestake Mining Co. Lands	300	--(4)	--(4)	1,298.49		---		1,298.49	
Other Private Lands	2,035	14	3,000	8,808.90		---		8,808.90	
Total treated by Forest Service Crews	42,440	2,834	106,000	183,435.52(2)		---		183,435.52(2)	
Treated by Other Crews									
State of South Dakota	1,506	250	65,000	3,304.90		3,304.90		6,609.80	
Homestake Mining Co.	2,003	333	6,000	900.00		4,006.00(5)		4,906.00	
Total treated by Other Crews	3,509	643	71,000	4,204.90		7,310.90		11,515.80	
GRAND TOTALS	45,949	3,477	177,000	187,640.42		7,310.90		194,951.32	

- NOTE: (1) Total expenditures less undepreciated value of equipment, supplies, and materials on hand at end of Project. (See appendix, page 1).
- (2) Does not include a considerable but indeterminate amount of contributed time by regular Forest Service personnel in direct supervision of control work, assisting in locating infested trees, and securing cooperative agreements for work on private land.
- (3) Does not include contributed time by National Park Service.
- (4) Volume and acreage included opposite "Treated by Other Crews - Homestake Mining Co."
- (5) Expenditures by Homestake Mining Co. have been arbitrarily set at \$2 per tree.

Div. of costs between the 2 National Forests and between National Forest and private land is on a proportionate basis, since Project records were not broken down in this way.

Based on data in the above table, the cost of control work done by Forest Service crews averaged \$4.32 per tree.

Treating accomplished by Forest Service crews in the fall of 1947 and up to March 6, 1948, amounted to 5,702 trees on the Black Hills National Forest and 2,803 trees on the Harney National Forest. This brings the total trees treated in the 1947-1948 infestation up to 54,454.

See "Map Showing Areas Treated" in the appendix.

RECOMMENDATIONS

From experience gained on this Project, the following recommendations are made for future control projects of a similar nature.

Spotting Methods

The importance of obtaining a first-class map cannot be overestimated. There are several factors which will help insure this:

- a. The most important of all is to have high caliber personnel doing the map work and in charge of the spotting crews. Experience gained on this Project emphasizes that this work cannot be satisfactorily performed by men of lower than P-1 caliber. These men should be permanent employees or men who hope to become permanent employees, since an interest in doing a first-class job is extremely important in this phase of the work. Continuity of assignment is also very important. The only way to successfully handle this type of work is to assign a sufficient number of well qualified men for the duration of the Project.
- b. As mentioned in the footnote to the Spotting Instructions in the appendix, it is believed that improved work and possibly higher production can be obtained in spotting by having strip sidelines run by a compassman in advance of spotting. The map prepared by this man will be used by spotting crews for indicating location of spotted trees. In this way, maps will be uniform in character. This method does not apply in areas of scattered infestation where it is not intended to do 100 percent spotting.
- c. Aerial photographs on an 8" to the mile scale are invaluable in map making. An overlay on linen map Form 878a can be stapled to the top of these photographs and used for actual mapping. Blueprints can be made of these for field use.
- d. Mapping in all roads, even though they are old and brush grown, is extremely important and must be done thoroughly and carefully by the compassman who runs the strip guide lines, and checked by the spotting foreman. If a road is used as a base line, it should appear on all maps made for adjacent areas.
- e. Training must be well and carefully done by well-qualified personnel very early in the Project. It is suggested this be handled by group training of the compassmen and spotting foreman, alternating between classroom lectures and field work until a satisfactory level of performance is obtained.

This should require about 2 days and should cover: General information on the infestation to be controlled; survey methods used in obtaining information about the infestation; methods to be used in spotting; rudiments of mapping; recognition of infested trees and pitch-outs; importance to the project of good spotting; and treating methods and problems in locating spotted trees by treating crews. After the project is well under way, assignment of spotting foremen to treating crews for a day or 2 will emphasize to them the necessity for thorough and accurate work. Training of spotters can be done by the spotting foremen as crews are organized. Unless labor conditions are unusually favorable, the personnel of spotting crews will be constantly changing, and the training process goes on until spotting is complete. Checking by the chief spotting foreman and camp superintendent is necessary to see that the job is done well.

Treating Methods

There is little to add to the techniques as described in treating instructions in the appendix. There follow a few points learned on this Project:

- a. Not more than 3 treating crews can operate satisfactorily under 1 treating foreman, and if the crews are not operating close together, 2 or even 1 may be the maximum.
- b. A chief treating foreman is absolutely essential on a large project. He must see that roads are available, that provisions are made to have insecticidal mixture available, and to properly deploy his forces to accomplish the job with greatest efficiency. His is a problem requiring much foresight and careful planning. This position should be filled by a man of wide experience in organizing field jobs and handling men. He should also understand the capabilities and use of equipment. He need not be a technically trained forester but should be a permanent employee of the Forest Service.
- c. One member of each treating crew should have had spotting training and experience. Infested trees will occasionally be missed by spotting crews, and trees will sometimes be spotted in error. This man can handle these situations. He would generally work out best as the nozzleman.
- d. A treating crew organization that works best is a 3-man crew for power treating and a 2-man crew for hand treating. These must be supplemented by insecticidal mixture supply men as necessary, depending on terrain, accessibility, and similar factors.
- e. The nozzleman invariably is the key man on the treating crew. He is the highest paid and is responsible for the work of the crew. There is always a tendency to "trade off" on the nozzle. It is tiring and disagreeable work. This practice must not be allowed except for short rest periods or in training new nozzlemen.

Comments on Various Types of Equipment

It is difficult to say that one type of equipment was better than another, since each filled a need and treated trees effectively.

The power wagons carrying a Bean fog pump and four 55-gallon drums of insecticidal mixture were very useful in heavy concentrations of reasonable accessibility. The power wagon was the least maneuverable but the most rugged equipment on the Project. Its use was well justified under conditions prevailing.

The Universal Jeep, carrying a Bean agricultural sprayer, was a versatile piece of equipment with a high degree of maneuverability. It gave access to places where the power wagon could not go and required a minimum amount of clearing. Its greatest drawback was the limited amount of insecticidal mixture hauled. If 2-wheel trailer tanks with a capacity of about 150 gallons could be obtained for use with this type of equipment, its value would be greatly enhanced.

The Gerotor pump, adapted for use on this Project at the Fort Collins Laboratory of the Bureau of Entomology and Plant Quarantine, proved very useful. It is light in weight and much less expensive than the Bean agricultural sprayer. Any suitable tank can be used with it for mounting on a jeep, or it can be mounted on a light frame with a jeep-can tank for carrying into rough terrain by hand. It was used in both ways on this Project and was highly successful in both. The pump is much more simple and less expensive than the Bean pump and, apparently, would be easier to maintain. It was the most economical type of power equipment on the Project in use of insecticidal mixture.

The portable power pump, developed in Region 4, was given a thorough trial. It is useful and does an adequate job but is not believed to be as rugged as the Gerotor, cannot develop as high pressures, and the pump has a tendency to heat under continuous use.

The Dobbins hand pump proved to be an inexpensive and effective tool. With an 8-foot extension it will reach as high as the other equipment under normal conditions. It is economical in the use of insecticidal mixture. The drawbacks are that it is not rugged enough and that the pressure tank quickly fills with insecticidal mixture and must be frequently drained.

The Myers hand pump appears to be a very satisfactory piece of treating equipment. It is ruggedly built and throws a stream higher than any other equipment used except the Bean pump at high pressure with a No. 8 disk. It is economical in the use of insecticidal mixture. Since an auxiliary pressure tank is not required, this pump does not have the objectionable feature of requiring frequent draining.

All nozzles used should be drilled to gun-bore smoothness. The No. 7 disk is the smallest that will give satisfactory results on power equipment. For tall trees use a No. 8 disk with 400 pound pressure per square inch. For hand pumps use a No. 6 nozzle.

Neoprene hose will not withstand deteriorating effects of the chemicals indefinitely. Further research is needed to find more resistant and lighter weight hose.

It is recommended that for jobs in similar terrain, a hand pump of the Myers type carried by hand or on a Universal Jeep be used for all except the heaviest concentration. For these heavy concentrations it is recommended that the Gerotor type of power pump mounted on a Universal Jeep be used. Jeeps, jeep trucks, or power wagons should be used for transporting men and insecticidal mixture to the scene of treating operations.

Treating Materials

Orthodichlorobenzene is preferred to benzene hexachloride for a control project such as this. It is now readily obtained in large quantities, is cheaper, less objectionable to handle, and does a thorough and effective job of control. However, benzene hexachloride is a satisfactory agent and can be used if orthodichlorobenzene is not readily obtainable.

Future Work on The Infestation

It is planned to make a $2\frac{1}{2}$ percent survey of the areas treated by the Project, using the plot system of sampling with $1/5$ -acre plots as the sample size. Aerial reconnaissance will be used wherever possible, especially in those areas not treated by the Project. This type of reconnaissance will be difficult in treated areas as the presence of treated red tops will be quite misleading. It is planned to use aerial photos as much as possible in mapping the areas to be surveyed. Treating maps, prepared during the course of the control Project and on file in Black Hills National Forest Supervisor's office, will be used in outlining survey plans. This survey will be started about September 1 and will take an estimated 6 weeks to complete.

In all probability there will be a mop-up job required in the fall of 1948 and spring of 1949. The amount of control work necessary is dependent upon results obtained by Project work and will be determined by the survey to be made this fall.

An infestation of the magnitude of this one could not have been effectively handled in the time available by any type of organization other than the one used. However, it seems apparent that if local forces and time are adequate, the mop-up should be accomplished without another large project. Local forces living at home and working under the general supervision of District Rangers can treat for less cost than if handled on a large project basis.

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A P P E N D I X

FINANCIAL STATEMENT
BLACK HILLS INSECT CONTROL PROJECT
AS OF AUGUST 14, 1948

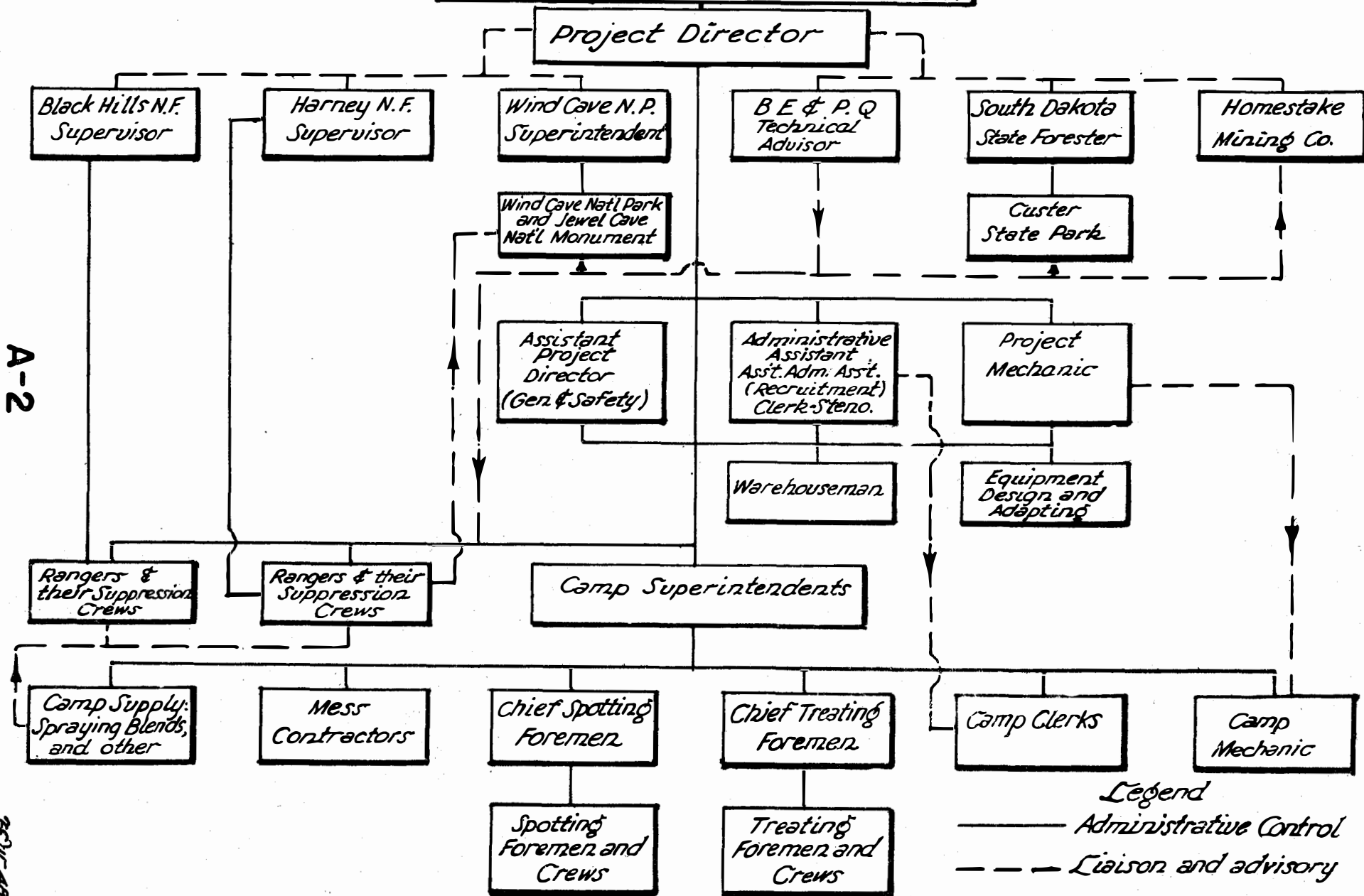
Direct Project Expenditures	PEST CONTROL
Personal Services	\$76,268.32 ✓
Subsistence	13,243.21
Travel	7,396.45
Transportation	1,937.32
Communications	547.96
Rent & Utilities	513.95
(1) Coop. - State of South Dakota	2,311.26
Other Cont. Services	5,297.82
Supplies and Materials	60,517.73
Equipment	23,430.32
Equipment Use	2,576.80
Total Direct Project Expenditures	<u>\$194,041.14</u>
 R.P.S.A. -	
Assigned to Project	11,914.48 ✓
Other	8,060.63 ✓ <i>96,172</i>
R.O. and Other Travel	381.25
Other	
Supplies and Materials	- 533.95
Communication	20.67
Transportation	24.45
Equipment	8.60
 W.O. withdrawals -	
Bureau of Entomology and Plant Quarantine	3,000.00
Coordinator	<u>1,000.00</u>
Gross Expenditures	<u>\$217,917.27</u>
 Unobligated Project Allotment	7,449.68
Unallotted R.O. Contingent	9,633.05
Total Allotments	<u>\$235,000.00</u>
Gross Expenditures	217,917.27
(2) Less Est. Fair Value Non-expendable Prop.	25,276.35
Less Est. Fair Value Supplies and Materials	5,000.00
Net Expenditures	<u>\$187,640.42</u> ✓

- (1) - Net cash reimbursement. Contributions in Kind \$993.64;
Gross \$3,304.90.
- (2) - Book value \$28,085.39, less 10% estimated depreciation.

Personal Services
Total 96,172 = 51.25% project cost.
PH

BLACK HILLS INSECT CONTROL PROJECT

R.O.DIVISION OF TIMBER MANAGEMENT



ORGANIZATION CHART

This chart gives a graphic picture of the organizational framework developed for the Project. It has not been possible to indicate all the details without making the chart so complex as to be difficult to understand, and a few words of explanation are given:

1. On Wind Cave National Park and Jewel Cave National Monument, the National Park Service spotted infested trees which were treated by Harney National Forest suppression crews as part of the Project program.
2. Work done on Harney-other work area was under the direct supervision of the Harney Forest Supervisor but financed with Project funds.
3. Work done on Black Hills-other work area was done by Forest suppression crews working under the District Rangers and the Project Director.
4. The Homestake Mining Company lands were largely treated by that company.
5. On a project of this nature it is essential to provide personnel and equipment for developing new equipment or adapting old equipment promptly as the need arises. This was not set up in a formal manner but was largely handled by the mechanics' force and the warehouseman.
6. Camp clerks were individuals who were selected as having the best possibilities and given such training as time permitted. They handled time reports and other similar matters. Experience proved that the organization would have benefited if qualified clerks had been available for the camps.
7. It was found necessary to provide each camp superintendent with a chief spotting foreman and a chief treating foreman. These men shared with him a part of his responsibility in their respective fields.
8. Because of the many difficulties and expense foreseen in operating a Government mess, the mess was contracted at each of the 3 camps. The camp superintendents were responsible for ordering meals and checking on the quality and quantity of food served.

Following is a list of the regular personnel detailed to the Project:

<u>Name</u>	<u>Forest</u>	<u>Project Assignment</u>
Paul P. McCord	Pike	Project Director 2/24-8/4
Walter C. Peterson	Pike	Asst. Project Director and Safety Asst. 3/16-4/30
E. J. Fortenberry	Gunnison	Asst. Project Director and Safety Asst. 4/27-7/24
Waldron A. Leypoldt	Routt	Administrative Assistant 3/18-8/4
William A. Campbell	RO-Operation	Clerk and Recruiting Officer 3/21-8/4
Genevieve E. Hammond	Uncompahgre	Clerk 4/6-4/28
Mabel A. Clements	Black Hills	Clerk 6/16-6/22
Louis S. McDonald	RO-Equipment Service	Project Mechanic 4/3-7/29
Jack Graw	San Isabel	Camp Superintendent 3/23-5/13
Ralph A. Smith	Harney	Camp Superintendent 4/28-7/30
Benjamin M. Whitehill	White River	Camp Superintendent 3/22-5/13
Paul I. Hauk	Arapaho	Camp Superintendent 4/27-6/9
Gus D. Reder	Harney	Camp Superintendent 4/4-7/30
John C. Smith	Harney (Med. Bow)	Chief Spotting Foreman 4/9-7/3
Milton J. Griffith	Harney	Spotting and Chief Treating Foreman 4/28-7/15
Daniel E. Turnbull	Rio Grande	Chief Treating Foreman 3/29-7/26
William Fernan	White River	Chief Treating Foreman 3/21-7/3
Glen M. Coe	Harney	Treating Foreman 4/12-7/22
Raymond E. Swigart	White River (Black Hills)	Chief Spotting Foreman 5/10-6/12
Richard C. Helm	White River	Equipment Operator 3/22-4/19
William Givens	Black Hills (Road Outfit)	Road Maintenance 3/25-5/29
Glen M. Hickman	Grand Mesa	Equipment Operator 3/22-5/29
Wade A. Warr	White River	Road Maintenance 3/25-4/17
Thomas W. Moe	San Juan	Equipment Operator and Mechanic 3/25-7/2
William G. McBride	Black Hills	Spotting and Treating 4/15-7/24
Ben B. Mahoney	Black Hills	Spotting 4/12-5/15
Raymond C. Hall	Black Hills	Spotting 4/26-5/22
LeRoy J. Cutler	Black Hills	Spotting 4/26-5/22
Robert E. Korthaus	Black Hills	Camp Clerk 3/29-7/17
Bernard G. Wilcox	Harney	Mechanic 5/18-7/28
Francis L. Milliken	Roosevelt	Mechanic 5/17-5/22

There was a total of 196 Form 676 employees, 30 regular employees not in Regional Permanent Salary Account, and 12 regular employees paid from Regional Permanent Salary Account.

SPOTTING INSTRUCTIONS

Spotting is the first and most important step in an insect control project. Its purpose is to locate, mark, and map all infested trees in such a manner as to enable treating crews to find them without loss of time.

It is not planned to cover the area included in the Project with a 100 percent cruise at the outset. Spotting will be done primarily on the areas of concentrated infestations leaving the areas of scattered infestations on which crews cannot spot an average of about 10 trees per man day until fading will assist both reconnaissance and spotting. It is planned to cover infested areas by aerial reconnaissance after fading occurs in order to determine where spotting is required in areas of scattered infestation.

In order that ground reconnaissance may be most effective in obtaining the largest number of spotted trees per man day, it will be necessary for the camp superintendent or chief spotting foreman to become familiar with locations of concentrated infestations by close contact with District Rangers. Ground reconnaissance should be done by them well in advance of spotting, and the results indicated on a 1/2" to 1 mile Forest base map. This will be done by indicating the areas which are to be covered by 100 percent spotting by cross hatching them with red crayon. Areas covered by reconnaissance, but on which 100 percent spotting is not to be done, will be cross hatched with a broken line; the cross-hatched lines to run from lower left to upper right. One master map will be maintained in the camp office for posting progress in reconnaissance, spotting, and treating. A copy of this master map will be maintained in the Project Director's office. It will be prepared initially by the camp superintendent and returned to him at convenient intervals for posting to date. The individual doing ground reconnaissance should obtain all possible information regarding the location of existing roads or of short spur roads to be constructed to give access to infested areas. The spotting crew takes over where ground reconnaissance stops. These crews will do 100 percent spotting in the areas indicated by ground reconnaissance.

NOTE: These instructions are based on "Instructions for Surveys and Control of Bark Beetle Outbreaks in the Central Rocky Mountain Region" prepared by Dwight A. Hester of the Bureau of Entomology & Plant Quarantine in May, 1939. They were revised early in this Project and were again revised on June 23 to include instructions which had been issued during the course of the Project. A few minor instructions were included at that time which had not been issued to the field and were, therefore, not being followed in spotting done on the Project. Since that time, Project personnel and the Bureau of Entomology & Plant Quarantine have agreed that the following change in procedure might have value: Survey strip boundaries (not center lines) at 5-chain intervals, marking this line well with stapled paper tags and marking stations at 5-chain intervals; the man surveying this line to prepare a map on an 8" to 1 mile scale showing all topographic and cultural features which will be of assistance to the treating crew; the spotting crews to use same map for showing location of spotted trees; and outside spotters to work to tagged lines.

The size of the spotting crew varies with timber type and topography. A 5-man crew, consisting of spotting foreman and 4 spotters, will be used on this Project.

Spotting foreman is compassman, keeps the spotting records and maps, and is responsible for the work done by the crew. Where the infestation is light, the compassman may find that less time will be required if he has one of the spotters keep the spotting record in addition to running his strip. The crew should be well trained before actual spotting is started. If some members of the crew have not had spotting experience, someone thoroughly familiar with the work should spend 2 days training them in the field before spotting is actually started.

Infested trees may ordinarily be recognized by small masses of pitch (pitch tubes) which exude from the hole made by the beetle entering the tree. Upon closer examination, it will be found that heavily infested trees usually have many small, reddish tubes with boring dust mixed with the pitch. Very heavily attacked trees may have very few or no visible pitch tubes. These trees can be identified by boring dust on the bark and at the base of the tree. Upon cutting through the bark, the presence of blue stain in the wood is a sure indication that the tree contains bark beetle brood. Woodpecker work in green trees indicates that insects are present. Large white pitch tubes sometimes indicate an unsuccessful attack and generally occur on trees which have had a sufficient pitch flow to overcome the attack. By hacking through the bark above such tubes, it will usually be found that the egg galleries are short and pitched out and frequently contain 1 or 2 dead adult beetles. Trees with attacks of this type only should not be marked. The spotters should not chop into trees unless it is necessary to do so in order to determine whether or not the tree is infested. An experienced spotter will not make more than 1 or 2 small hacks on a tree to determine whether or not it is a "bug" tree.

Some "red tops" will contain live larvae. These are unimportant in number, and the trees will not be spotted. No time will be consumed in "sampling" red tops to determine presence of live larvae.

Prior to spotting, it is necessary to establish a base line or lines from which all trees are located. Base lines should follow roads or trails that will be easily accessible to treating crews. A traverse survey of these base lines is made, marking stations every 10 chains. The stations should be marked with a piece of flagging, and a white tag will be stapled on the side facing the trail or road marked with black lumber crayon as follows:

Strip A	(B, C, etc.)
Sta. 1	(2, 3, etc.)
I. C.	(Insect Control)
48	(1948)

When the crew is ready to start spotting, the compassman starts at a station and paces the distance on a cardinal compass, bearing approximately perpendicular to general direction of the base line, keeping track of chainage on a tally register. The compassman should not look for infested trees but should map the country covered by indicating infested trees, streams, ridges, trails, rock outcrops, fences, and other objects that will enable the treating crews to locate more readily the infested trees. For this work a map drawn to the scale of 8" to the mile is preferable. At each 5-chain point on the strip line the compassman staples a white tag on a tree and indicates the following:

Station Number

Strip Letter

Center Line (indicating that the compass line is in the center of the strip).

The center line will be well marked by bark blazes or unmarked white tags at intervals which are frequent enough to insure ease of following by treating crews. When the center line crosses ridges, trails, roads, or any other such feature, the strip number and a reference to the nearest station should be shown.

The spotters are deployed 2 on either side of the compassman. Each spotter covers a $1\frac{1}{4}$ chain strip; the spotter on the outside bark blazes the outside edge of his strip so it can be followed on the next strip. The crew guides on the compassman, the inside man on the left and right slightly to the rear of the compassman, and the men on the outside wings slightly to the rear of the men immediately adjacent to the compassman. The compassman must adjust the organization of his crew to meet varying conditions. It may work out best for him to progress in 1 or 2-chain jumps, establishing stations at 5-chain intervals as set forth above. This will permit spotters to guide more closely on him, and he will be better able to offer guidance and otherwise check on the work being done by his men. The foreman need not necessarily stay right with his compass. He should circulate among members of his crew from time to time, checking trees marked or unmarked, width of strip, diameters, and blazing. He is responsible for supervision and training, as well as running the compass line and mapping and recording of data on infested trees.

Each spotter is responsible for finding, marking, and numbering infested trees occurring on his strip. When a spotter finds an infested tree, he calls, "Bugs," and the entire crew stops. He then calls the approximate number of trees to be marked. If there is a sufficient number of trees, the other spotters assist in marking them. Upon encountering a fence, mine shaft, or other prominent object, he should call out such information to the compassman, who will include it on the map.

The infested tree is tagged with a yellow tag at head height, and the compassman calls the number to be placed on it. The spotter records the number given, his initials, and the area number on both top and lower portions of the tag with grease pencil. Single trees should have tags placed on 3 or more sides. Groups of 2 or 3 trees need be tagged on 2 sides only, while in larger groups, trees will be tagged on one side only. When infested trees occur as singles or doubles, the spotters should note the severity of the attack. If the tree is only lightly hit, or the beetles are confined to one side of the tree, or for other reasons the spotter does not think the tree will produce many beetles the following summer, he should tell the compassman that the tree is a questionable "bug" tree. If these questionable trees are isolated, or, if for other reasons, considerable expense may be involved in treating them, it may be advisable to leave them untreated. Decisions regarding this are the responsibility of the spotting crew foreman. When all trees of a group have been marked, the spotters should check on the numbers and look for trees which might have been missed. When it is certain that all infested trees in the group have been properly marked, spotters return to their former positions and continue on the strip.

The following equipment is necessary for a 5-man spotting crew:

- 1 staff compass and staff
- 1 tally register
- 4 hand axes with sheaths for carrying on belt tags (yellow cardboard)
- 1 tatum holder (letter-size if using aerial photo and Form 878d's; otherwise, one-half letter-size)
- 1 map of area (8" to 1 mile) or aerial photograph with transparent overlay.
- 1 hammer stapler
- grease pencils
- nails
- spotting record forms in half letter-size tatum holder
- pencils.

Maps drawn in the field should be to a scale of 8" to the mile. Each such map should show, when complete, location of spotted trees, base line and strips, any landmark that will be of value in locating spotted trees, total number of spotted trees included within map area, and the acreage covered by 100 percent spotting within map area. It should also show the section or sections, townships, and range, and may, if desirable, bear a unit designation, such as Bear Creek, Bull Mountain, etc.

A large scale progress map will be maintained in the camp office showing base lines, stations, area covered, and number of trees found on each 10-chain strip.

The spotting records will show crew number, tree numbers, and tree diameters. These, together with the spotting maps, are turned over to treating crews and are the basis for locating trees to be treated.

When an area is covered by spotting, a record will be made on the master map referred to in connection with the ground reconnaissance above by cross hatching in red crayon from lower right to upper left.

A part of the spotting foreman's responsibility will be to make adequate notes regarding possible location of spur roads to be constructed for access to infested areas by treating crews. This will amount to checking the information indicated by ground reconnaissance and providing further detail. This work should be done well enough and record made in such a manner that a minimum amount of time will be experienced in properly instructing road construction crews.

TREATING INSTRUCTIONS

Introduction

The final phase in a forest insect control project is treating infested trees. The method used on this Project is new in that such trees are to be treated in a standing position with a mixture of either orthodichlorobenzene or benzene hexachloride in No. 2 burner fuel. The success of treatment depends upon complete coverage of the total infested bark surface. Height of infestation generally varies from 20 to 35 feet, being lower in very small trees and higher in very large trees. The height of infestation may be determined visually by the presence of pitch tubes and woodpecker work. A rule of thumb will be to treat about 75 percent of the total length of the bole. An average of about 3 gallons of insecticidal mixture will be required per tree.

Types of Equipment

Bean Agricultural Sprayer, Model No. 4700 MT, powered by a Briggs Stratton gasoline engine, together with a 500 linear foot capacity live reel, all mounted on a Universal $\frac{1}{4}$ -ton Jeep.

Bean Fog Pump, powered by Wisconsin Model AB or AK gasoline engine, together with live reel and auxiliary insecticidal mixture tanks, all mounted on a Dodge Power Wagon.

Portable power pumps to be used on an experimental basis.

Dobbins Model 3171 Hand Pumps, modified to provide handles for carrying, and 1 Myers Model 336 $\frac{1}{2}$ B. The Dobbins pumps are equipped with pressure tank for maintaining constant pressure, and both types are equipped with 25 to 40 feet of neoprene hose.

Auxiliary equipment available for some pieces of power treating equipment is an injector type refiller which can be connected to the pressure line of the pump for refilling pump tanks with insecticidal mixture.

All power treating equipment is equipped with neoprene high pressure hose.

Various types of spray guns are available, including 1 Myers High Tree Gun, Bean No. 785 Spraymaster Guns, and a number of simple guns developed on the job. The hand pumps are equipped with various types of extension rods to gain height and a modified Dobbins No. 519 long distance nozzle.

Operation of Equipment

1. Bean Power Sprayers

Check the following points before starting each morning:

- a. Spray tank strainer should be free from dirt.
- b. Grease cups on pump and on live reel should be full of grease. (Water pump grease #250 is recommended for this).

- c. Thoroughly grease pump gears and oil drive chain with same weight oil used in engine- SAE #30 (V belts should be kept oil free).
- d. While operating pump, turn all grease cups down often enough to be sure that all moving parts are well supplied with lubricant; also, frequently oil chain, plunger guides, and apply grease to gears. Sufficient #30 lubricating oil should be applied to oil holes in pump wrist pin to keep oil space full.
- e. See that the gasoline tank is filled with "white" gas.

In case of pressure losses, check the following points:

- a. Air leak in suction piping or suction hose, or a missing drain plug. Air leaks cause uneven pressure, air locks, severe chattering in valves, and extreme fluctuation of pressure gauge needle.
- b. Completely clogged suction of filter strainer. A severe pounding or a distinct knock in pump is indicative of this condition.
- c. Pump plunger worn and dry. Worn or dry plungers are indicated when insecticidal mixture bypasses the worn plunger and runs out the top of the cylinder. Worn plungers should be replaced as soon as leakage is noted; otherwise, cylinder walls may be damaged.
- d. Valve parts may become worn. When this happens, valve parts should be immediately replaced.
- e. Air lock in valves. Release air to correct.
- f. Pressure loss when nozzle is closed. Ascertain if overflow from pressure regulator or relief valve is flowing back into tank. If this overflow continues, the trouble is in the regulator relief valve. This fault may be caused by any of the following:
 - (1) Foreign matter that may be lodged under valve ball.
 - (2) Worn parts in top valve of regulator.
 - (3) Stem set too high under valve.
 - (4) Worn plunger cup or diaphragm.

2. Region 4 Portable Power Pump

Instructions for operation of this equipment will be found in the 1948 ~~Targha~~ Teton Bark Beetle Control Project General Instructions.

3. Geroter Portable Power Pump

This pump can be operated at pressures up to 1,000 lbs. per square inch without injury. For normal treating jobs the pressure should not exceed 90 lbs.; however, if more pressure is needed for especially tall trees, the pressure can be increased by screwing down the cap on the pressure relief valve located directly over the pump. This pump is strictly an oil pump, and under no conditions should it be used with any other liquid.

4. Dobbins Portable Hand Pumps

When operations are started with this pump, the shutoff cock should be closed until pressure in the pressure tank has been built up to approximately 50 lbs. The cock is then opened and the pump operator continues to pump, maintaining the given pressure until treating operations are discontinued. It will be found that less time is wasted if pressure is maintained when traveling from one infested tree to another. This may be done by closing the shutoff cock.

5. Refiller

Bean Refillers should not be attached to sprayer tank except when actually in use. To attach refiller, connect small hose to discharge of pump. Hook refiller dome on tank with nipple in hole of tank. Completely submerge strainer in source of insecticidal mixture with pump running at full capacity and pressure, open valve from pump discharge into small refiller hose. Within a few moments insecticidal mixture commences to flow through refiller into sprayer tank. If refiller fails to work, look for the following faults:

- a. Insufficient pressure from pump.
- b. Clogged injector nozzle.
- c. Air leak in suction hose or connection.

Treating Techniques

1. Bean Power Sprayers

Pump pressure and nozzle size: Normal operation will be with 200 lbs. pressure on the pump gauge and using a No. 7 disk in the Bean spray gun or a modified Dobbins No. 519 long distance nozzle with a No. 6 hole. For each 100 feet in elevation of the nozzle above the pump, the pressure on the gauge will have to be increased approximately 50 lbs. in order to maintain sufficient pressure at the nozzle. It must not be thought that the converse of this will be true. In other words, the pressure at the gauge cannot be lowered an increasing amount if the nozzle is below the pump, since a minimum of 200 lbs. of pressure at the pump is required to deliver a sufficient amount of insecticidal mixture. For extra height required

on tall trees, use a Bean spray gun with a No. 8 disk and increase pump pressure to 400 lbs. This will waste several gallons of insecticidal mixture per tree but will still be cheaper than felling.

Application of Spray: The nozzleman will take his stand about 6 to 8 feet from the base of the tree and aim the nozzle at the highest portion he intends to spray before opening the nozzle valve. Maximum height may be obtained by holding the nozzle overhead at arm's length. At maximum height the stream will be broken up considerably and must be directed steadily on one point of the bole for several seconds in order to allow a sufficient accumulation of insecticidal mixture to thoroughly wet the bark. It may be desirable for the nozzleman to shut off the valve for a visual check when he thinks the bark is thoroughly moistened. When the bark at the upper portion of the bole is thoroughly moist, the spray stream will be moved slowly and steadily down the bole, keeping it just ahead of the build-up of insecticidal mixture, which will flow downward on the bark, until the base of the tree is reached. On the lower portion of the bole where the diameter increases, movement of the stream from side to side will obtain maximum coverage. Care must be exercised in this last motion to avoid directing the stream past the bole and wasting insecticidal mixture. Wastage may also be avoided if the nozzleman will walk backward from the tree as the stream approaches the base so as to reduce splash. This last operation must be done cautiously by the nozzleman in order to avoid tripping and falling.

The trees should be covered in vertical sections, each of which slightly overlaps the previous section, until the complete circumference has been treated. Complete coverage is essential to complete control, and it is better to treat to excess than to apply insufficient insecticidal mixture.

Production will be increased when treating several trees close together by treating as much of each tree as possible from one position rather than by treating each tree completely before going to the next.

The hoseman's duties are to record tree numbers, to see that the nozzleman always has slack hose, to assist the nozzleman by calling his attention to any portion of the bole he may have missed, and by cautioning him if he is about to move in such a manner as to be in danger of tripping.

The pump tender sees that the pump is working properly and assists in handling hose as necessary.

When reeling in hose, the nozzleman should stay on the nozzle end to see that it is brought in without injury to the nozzle and to keep it from kinking or becoming tangled in brush, stumps, and rocks.

When moving pumps for short distances or when there are short periods when spraying will not be done, the pump should not be shut down. Whenever the pump is shut down, there will be waste of insecticidal mixture which may easily cost more than the small amount of gasoline used in the pump engine.

2. Portable Power Pumps

Operation is referred to elsewhere in these instructions. Treating techniques are the same as for the Bean power sprayer except for operating pressures. Extension nozzles are required to obtain heights comparable to the Bean power sprayers.

3. Hand Pumps

Treating techniques are about the same as for power sprayers. Because of lower pressure, more time will be required in treating a tree. This will also result in less loss from splash. Even with an extension nozzle, height obtained will be somewhat less than the maximum possible for power outfits but will be sufficient for most trees on this Project. If the stream fluctuates with each stroke of the pump handle, the pressure tank has become filled with insecticidal mixture and must be drained. If this is done at a time when the can is empty and the pump handle moved through several strokes while the drain is open, air will be forced into the tank and liquid forced out.

For picking up a few trees just beyond reach of a power outfit, time and expense may be saved by pumping the insecticidal mixture to jeep cans with a power outfit and carrying the full cans from the end of the hose to the trees to be treated.

Records

In order that spotting records may be completed to show treatment, the number of each tree treated will be entered in a field notebook by the hoseman if spotted trees have been marked by a blaze. Where they have been marked by a tag, the lower portion of the tag will be torn off and retained in lieu of maintaining a notebook record. Infested but unspotted trees located by treating crews will be treated and a record of the number entered in a field notebook. At the end of each day's work, each treating crew will turn into the treating foreman a record of all trees treated for the day. These tree numbers will be currently entered on spotting records in camp. In order to facilitate checking comparative efficacy of the 2 types of spraying blend used, trees treated by benzene hexachloride will be so indicated on either the blaze or the tag remaining on the tree by a small, equilateral triangle. This symbol will also be entered on the field notebook opposite tree numbers or on the tags turned in to the treating foreman, and a similar symbol will be entered on camp spotting record opposite appropriate tree numbers.

The camp progress map will be posted to show areas treated by filling them in solid with red crayon.

SAFETY INSTRUCTIONS

General

1. Each man will be adequately clothed before beginning work.
2. Each man will be supplied with a copy of the safety instructions. He should study them thoroughly and work accordingly.
3. Every man employed will be required to attend all safety meetings and training sessions when summoned.
4. Absolutely no liquor will be allowed in camp, and any man appearing for work intoxicated will not be retained on the Project payroll.
5. Clothes racks or drying racks will be kept away from stoves.
6. Some sort of metal ash trays or cans will be used in living quarters for safe disposal of cigarettes.
7. Keep living quarters clean and tidy at all times.
8. Know where fire extinguishers and water systems are so that immediate action can be taken in case of fire.
9. Sanitation facilities have been supplied for your own protection -- use these facilities.
10. Use all equipment only for the purpose for which it is intended.
11. Horse play is a forerunner of accidents. Keep your mind on your business.
12. There is no substitute for sound judgment and common sense. THINK SAFETY, WORK SAFELY, STAY HEALTHY, USE YOUR HEAD.

Spotting Crews

Hazards encountered in the woods are numerous. The following constitutes specific hazards you may encounter and each man should always be alert to such hazards and must be his own safety officer.

1. Wear rubber soled shoes with rubber heels, 9 or 10 Hungarian hobs (cone shaped) in the instep, or leather soles and heels with plenty of Hungarian hobs.
2. Shoes not less than ankle height, preferably with 8" tops or higher. No cowboy boots. Shoes or boots to fit comfortably. Socks to be at least 50 percent wool. Treat all blisters promptly.
3. Pant legs without cuff, not to fall below the ankle, staggered of 6" higher if 10" or 12" boots are worn.

4. Hand axe or other edged tools to be carried in a sheath to and from the job.
5. On steep side hills, carry edged tools on the down-hill side.
6. Every axe will glance sometimes, no matter who is using it. Have feet, legs, and hands out of the way when it does glance.
7. When riding jeeps or pickups on wood roads, beware of eye injuries due to low hanging limbs or dead branches.
8. Stand sideways to tree and avoid chopping toward any part of the body.
9. Each spotter will be responsible for his own hatchet. Broken, cracked, or splintered handles will be immediately replaced, using standard grade wedges.
10. Axe throwing is absolutely prohibited.
11. Hatchets should be kept sharp at all times. Use files equipped with handles and sharpen from eye to edge while hatchet is in a secure position. This should be done in camp, and files should not be carried in the pocket.
12. Be certain that you have a secure grip on the hatchet when cutting. Be extremely cautious when gloves are damp.
13. All trees should be carefully scrutinized to determine presence of sleepers, snags, or widow makers. When blazing this sort of tree, tap lightly and keep alert.
14. Men will be seated at all times when vehicle is in motion.
15. Any unsatisfactory condition existing on the part of the driver will be reported immediately.
16. If a man is awkward in the woods and falls down, stumbles, or collides with limbs, trees, or rocks, he will be discharged or assigned to other work.

Any employee working for the Forest Service is individually responsible for the safe, efficient completion of the job to which assigned. Report any hazards immediately. BE ALERT, WORK SAFELY.

Treating Crews

There are numerous hazards involved on any forest job. Each treating foreman shall thoroughly familiarize himself with all known hazards and instructions applying to each. Upon him rests the job of thoroughly training his men in safety and especially that part which specifically applies to treating. Be alert at all times to recognize any hazard that may develop in the course of your work. Take immediate steps to

correct any unsatisfactory condition and report same to the safety officer. Upon you rests the responsibility for the safe, efficient working of each crew member. The following is a list of known hazards and instructions governing each:

1. Be sure fire extinguisher on treating truck is full and in operating condition and can be obtained quickly.
2. Keep tank, pump, and motor wiped off and free of dirt and surplus oil. Have clean wiping rags always available.
3. See that all pump and hose connections are tight.
4. Wear the protective equipment furnished. Obtain replacements if lost or damaged.
5. Apply protective cream to skin surfaces which will be exposed to oil or insecticidal mixture.
6. Wash thoroughly at least every night all skin surfaces exposed to oil or insecticidal mixture, using soap and hot water. Oil saturated clothing should be changed immediately and washed often.
7. Watch for and report to foreman any rash, itch, or swelling on the body.
8. Never use fog spray in applying mixture. Don't stand where the wind will blow insecticidal mixture on you.
9. Do not store oil saturated clothing in buildings and stay away from fires or stoves when clothing is covered with insecticidal mixture.
10. No smoking when mixture is being applied or when in the vicinity of treated trees or on truck hauling insecticidal mixture.
11. If the solution reaches the eyes, flush with lots of water or boric acid solution.
12. Don't use an axe while wearing oily gloves or when the hands are greasy.
13. Wear rubber soled shoes with rubber heels, 9 or 10 Hungarian hobs (cone shaped) in the instep, or leather soles and heels with plenty of Hungarian hobs. Nozzlemen should wear neoprene boots which are furnished.
14. Shoes not less than ankle height, preferably with 8" tops or higher. No cowboy boots. Shoes or boots to fit comfortably. Socks to be at least 50 percent wool. Treat all blisters promptly.
15. Pant legs without cuff, not to fall below the ankle, staged off 6" higher if 10" or 12" boots are worn.

16. On steep side hills, carry edged tools on the down-hill side.
17. When riding jeeps or pickups on woods roads, beware of eye injuries due to low hanging limbs or dead branches.
18. Do not attempt to lift filled barrels or other heavy objects -- secure assistance. When lifting, keep knees together, secure firm footing, and have body in a natural position. Lift with the legs.
19. Do not walk on logs or wind-thrown timber.
20. When riding to and from the job, all tools will be properly boxed and secure and not be loaded loosely with the men.
21. Men will be seated at all times when vehicle is in motion and at no time will leave the vehicle until it is completely at rest.
22. Horse play while riding or at any other time is hazardous and will not be tolerated.
23. Any unsatisfactory condition on the part of the driver or equipment should be reported immediately so that steps can be taken to correct the situation.

It is your individual responsibility as crew members to observe any hazards that may exist and report these immediately. Employees who show lack of interest or apparent disregard for instruction should be discharged. Accident prone, clumsy, listless employees will not form a part of the insect control organization.

Supplemental Instructions for Pump Men

Spilling Gasoline

Be careful not to spill gasoline on a hot engine and never fill tank while engine is running.

Safety Filling Can

Use approved type safety can when filling gasoline tank. Never use open containers. Be sure the delivery can is grounded by holding the nozzle of the can on the tank opening. There will be no smoking within 50 feet of men filling any gasoline tank or container.

Do not fill gasoline tank more than 3/4 full because vibration will cause gasoline to spill from filter cap vent and run onto hot engine. It quickly vaporizes and will ignite from a spark when the stop switch is pressed against the spark plug.

Cranking Engine

Pull the rope with a quick but steady pull in order to prevent it from falling on the engine in case of kick-back. Do not wrap cranking rope around hand when starting engine. Obtain ample clearance when pulling rope to prevent striking someone or some object behind you.

General

1. Protect hands by use of gloves.
2. Work with shirt sleeves rolled down.
3. Keep neck covered by turning up collar.
4. Keep trouser legs rolled down over the ankles.
5. Use protective cream as directed.
6. Never rub the eyes or wipe off perspiration with the hands.
7. Wash hands with mild soap.
8. Bathe daily.
9. In case oil or gasoline is spilled on your person, wash off immediately with water for antidote.

Equipment Operations

General

1. All drivers shall have successfully passed the Federal driver's test and received a Government operator's license before operating any Government-owned or rented vehicle.
2. Student drivers should always be accompanied by competent instructors during the training period.
3. Observe the Laws! Forest Service drivers should know and comply with State and local traffic regulations.
4. Do not pick up hitch-hikers.
5. Forest Service vehicles should be properly equipped in accordance with State and Federal motor vehicle laws. This includes proper lights, rear view mirrors, flares, projecting load warning flags, and brakes. In addition, every Forest Service vehicle should be equipped with a first-aid kit.

6. Drivers should:

- a. Drive always at a speed which permits full control, and never in excess of 40 miles per hour.
- b. Always make allowance for existing road and weather conditions.

Loading and Hauling

1. Every vehicle which may be used for transporting persons should have:
 - a. Sufficiently high and strong guard rails to prevent falls.
 - b. Suitable seats anchored to the vehicle bed.
 - c. Substantial steps or end gates for loading and unloading.
2. Men and tools or supplies may be hauled together only when:
 - a. Tools are enclosed in substantial tool boxes - attached to the bed and equipped with cover that can be securely fastened.
 - b. In emergency, tools are wrapped in canvas or other material and lashed to the bed.
 - c. Supplies are securely lashed to the truck bed.

Caution

1. As a general rule, not more than 1 passenger should ride in the front seat with the driver. Exception: in larger cabs, when driver has sufficient room to manipulate controls, 2 passengers may ride with driver.
2. Passengers may ride only in cab or body of motor vehicles. This means:
 - a. No hanging of arms or legs over sides or ends of body.
 - b. No standing up while vehicle is in motion.
 - c. No riding on hood, fender, or running boards.

Supplemental Instructions for Vehicle Operators

When using winches on power wagons, observe the following:

1. When necessary to block or secure the vehicle for winching, be certain that chain is securely fastened near base of large, firm trees that are free from sleepers, widow makers, wind throws, etc.

2. Do not fasten anchor chain to rocks or ledges that are above the level of the vehicle wheels. This will avoid injury from rolling rocks.
3. Be very cautious when handling cable. Worn, splintered, or frayed cables will be replaced immediately. Watch for wire splinters. Use gloves.
4. Thread cable through pulleys and blocks with caution. Serious cuts and mangled fingers may result from careless handling of pulleys.
5. Chains and hooks fastened to cable for pulling should be securely fastened with standard cable clamps.
6. See that no one is within cable length of equipment working before beginning pull.
7. Do not use winch for pulling trees. Use only when necessary for removing hazards. When this is done, use cable that is $1\frac{1}{2}$ to twice as long as the tree height and observe all above instructions. Post a lookout -- keep alert.
8. Man guiding cable onto drum should stand 3 feet from winch and use a stick for a guide.
9. Power wagons will not be put to use as a trail blazer. The same care shall be taken with these vehicles as any other automobile.
10. Never apply power to winch for any except light pulling when transmission is in neutral.

Safety Analysis of the Axe

The proper method of using and carrying will prevent a great majority of the accidents which occur from using an axe. Following are some pointers on the proper use of an axe which, if followed, will increase the amount of work done, make it easier, and help to eliminate accidents:

1. Use the proper grip on the axe when cutting. The axe should always be used with 2 hands, except when sharpening stakes or some similar operation. The left hand should retain a firm grip near the end of the handle at all times. On the upward stroke, the right hand slides up the handle toward the head. On the downward stroke the right hand slides down the handle coming to rest just above the left hand.
2. When chopping a log on the ground, stand on top of it, if it will provide a firm foot-hold. Chop half way through on one side and then finish from the other side. Do not stand on small logs as they do not provide a firm foot-hold.

3. Always cut on an angle to the grain of the wood. This is easier on the blade of the axe, and the axe can be driven in farther with the same effort.
4. Never cut into the crotch of a limb - always cut from the bottom side. This is easier on the axe and the chopper because the blade is cutting with the grain, and it also leaves a smooth trunk.
5. Do not drive your axe into the ground. Dirt and stones will dull and nick the blade.
6. Do not chop through knots. They are hard to chop and are hard on the axe blade.
7. Always have a solid support under the piece you are chopping. This makes cutting easier and avoids the danger of flying pieces.
8. Make certain that whatever material you are chopping is firmly held. If the piece of wood wobbles, the axe is liable to glance off, and you may be cut.
9. Always carry an axe by the handle, close to the head. Never carry it on your shoulder. A slip or fall might result in a nasty cut.
10. When limbing a tree or using an axe for other than chopping a log or standing tree, always swing the axe away from you to avoid cutting yourself if it gets out of control.
11. Before starting to chop anything, be sure that all vines, branches, or other things that may interfere with the swing of your axe are removed. Such things will cause the axe to glance and get out of control.
12. When not using the axe, lean it against but do not drive it into a log or stump.
13. Before starting to chop, be sure that everybody in the vicinity is out of harm's way.

The axe is one of the most useful and handy tools we have. A great majority of the accidents resulting from its use are the result of plain carelessness and negligence. If the above rules are followed, combined with some common horse sense, it will be found that more work can be accomplished with less expended effort, and that the opportunities for accidents will be decidedly decreased.

Safety Analysis of Saws

Although not so many severe injuries are caused by saws, there is a considerable number of ragged, hard-to-heal cuts resulting from improper use and carelessness in the use of this tool.

Handsaws - Possible Injuries and Causes:

1. Ripping hand while holding object being sawed.
2. Ripping body by falling on saw.

Means of avoiding above injuries:

Keep hand holding object far enough away to eliminate danger of hand being cut if saw jumps from the mark or kerf. Use caution when footing is insecure or slippery. Hang saw in safe place while not in use.

Two-Man Cross-Cut Saw - Possible Injuries and Causes:

1. Ripping leg by standing so that saw rips into leg while sawing through object.
2. Ripping body while sawing or by falling on saw.
3. Pinching finger between saw handle and object being sawed due to one man pulling saw through too far.
4. Ripping leg due to one man pulling saw back out of kerf or pushing far end of saw against other sawyer's legs.

Means of avoiding above injuries:

1. Stand so as to make it impossible for saw to cut into leg. If sawing a horizontal object, stand far enough to one side to be clear of saw. If sawing a vertical object, such as a tree, keep moving back as the cut progresses so there is always a safe distance between saw and legs.
2. When not in use, lay saw so no one will step or fall on it. Carry saw balanced on shoulder with teeth out, grasping front handle to hold in place.
3. Avoid taking such long strokes as to pinch fingers of other man between saw handle and object being sawed.
4. Avoid any sudden movements of the saw which might catch the other sawyer unaware and in some way cut him.

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Memorandum of Understanding
Between the
State Forester of South Dakota
and the
Regional Forester, Denver, Colorado

This memorandum of understanding, made under authority of Sections 2 and 4 of the Act of Congress approved June 25, 1947 (Public Law 110, 80th Congress), hereinafter called the Forest Pest Control Act, this 20th day of May, 1948, by and between the State Forester of South Dakota acting in behalf of the State of South Dakota (hereinafter called the State Forester) of the first part and the Regional Forester, Denver, Colorado, acting in behalf of the United States of America (hereinafter called the Regional Forester) of the second part,

WITNESSETH:

WHEREAS, the State Forester has requested the cooperation of the Regional Forester in the control of forest insect epidemics in the Custer State Park of South Dakota; and

WHEREAS, funds appropriated by the Congress under the Forest Pest Control Act for insect control operation in the Black Hills area of South Dakota and Wyoming have been made available for expenditure by the Regional Forester; and

WHEREAS, the Secretary of Agriculture has authorized cooperative insect control activities with the State of South Dakota within the Custer State Park during calendar year 1948 under the Forest Pest Control Act in amount not to exceed \$15,000 and has fixed \$5,500 as the estimated contribution from the State for this cooperative project in accordance with Section 4 of said Act, said contributions to be in wages and equipment expenditures to be made at such time and in such manner as are satisfactory to the Regional Forester at Denver, Colorado, under the terms of the memorandum of understanding with cooperating agencies; and

WHEREAS; The Bureau of Entomology and Plant Quarantine through its Forest Insect Laboratory at Fort Collins, Colorado, is cooperating with the Forest Service in forest insect control activities in the Black Hills area by providing technical advice, supervision, and guidance; and

WHEREAS, in consideration of the mutual benefit to be derived under this agreement, the contributions of both parties shall be approximately of equal value.

Now, therefore, the said parties agree with each other to conduct a forest insect control project on the Custer State Park of South Dakota under the conditions hereinafter provided, to wit:

Article I. The State Forester agrees:

1. To organize and direct the work of felling and treating infested trees, using State employees and materials, equipment, and facilities of the State except as otherwise provided in this agreement.
2. To conduct control work under the technical supervision and guidance which will be furnished by the Bureau of Entomology and Plant Quarantine.
3. To initiate the work and pay the costs thereof from State funds with the understanding that from time to time reimbursement from the Federal Government for its share of costs will be made as hereinafter provided.
4. To cooperate on approximately a 50-50 basis regardless of total expenditure, with \$5,500 maximum contribution by either party unless mutually changed later.
5. To permit representatives of the Forest Service and Bureau of Entomology and Plant Quarantine to inspect the work in progress, review and audit accounts to determine that expenditures claimed for reimbursement have been made and are properly chargeable to the project and to request progress reports and final report of accomplishments at the close of the project.
6. To maintain adequate accounting records, furnish monthly statement on standard Form 1034, and make available to the Regional Forester, as requested, detail and evidence of expenditures sufficient to accomplish complete audit.

Article II. The Regional Forester agrees:

1. To make arrangements for technical supervision and guidance of the project in cooperation with the Bureau of Entomology and Plant Quarantine.
2. To supply such materials and small tools and equipment needed for the project as he may have available to the State Forester on his request. The cost of such materials and small tools and equipment shall be deducted from the amount of reimbursement due the State on account of expenditures made by the State under this memorandum of understanding.
3. To loan large equipment needed for the project, as may be available, to the State Forester at his request. The cost of operating such equipment based on the standard Forest Service rental rates for such loaned equipment shall be deducted from the reimbursement due the State on account of expenditures made by the State under this memorandum of understanding.

4. To facilitate the work, reimbursement of not to exceed 50% of the current project expenditures shall be made to the State. Such payments shall be made from time to time at the request of the State Forester (but not more frequently than at intervals of 14 days unless agreed to by the Regional Forester), based upon such showings as the Regional Forester may require of actual expenditures to date by the State taking into account deductions to be made under items 2 and 3 hereinabove. The maximum Federal contribution to the project in cash reimbursements to the State and values supplied directly by the Federal Government under items 2 and 3 hereinabove shall be limited to \$5,500, but nothing herein contained shall be construed to prevent the parties from making supplemental arrangements for additional work up to a total amount of \$15,000 during the calendar year 1948 under the same or different provisions with respect to the amount of cost to be borne by the State and the Federal Government.
5. To recognize the following classes of State expenditures made on or after April 12, 1948, in computing amounts of reimbursement due the State:
 - a. Salaries and wages of project personnel.
 - b. Expenditures for equipment provided any item costing more than \$100 is approved by the Regional Forester.
 - c. Expenditures for operation and maintenance of equipment.
 - d. Rental charges on large State-owned equipment, such as trucks, pumper sprayers, and power saws at rates similar to those currently enforced on similar Forest Service equipment or at such other rates as may be mutually agreed upon.
 - e. Expenditures for materials used in connection with the project.

Article III.

Items of value which remain at the completion of work covered by this agreement and which each party by contributing in accordance with terms of this agreement has in effect a 50% interest shall be divided as mutually agreed upon by both parties with any differences in values based on original cost to be considered in determination and settlement amount of contributions of each party.

It is expressly understood and agreed between the parties hereto that project control work shall terminate upon expenditure of funds available or upon request of the Regional Forester in accordance with advice from the Bureau of Entomology and Plant Quarantine. If funds are available after control work has ceased, the balance may be used on a cooperative survey and additional control work in the fall of 1948 but not after December 31, 1948.

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No member of or delegate to Congress or resident commissioner after his election or appointment, and either before or after he has qualified and during his continuance in office, and no officer, agent, or employee of the Government shall be admitted to any share or part of this contract or agreement or to any benefit to arise thereupon. The provision herein with respect to the interest of members or of delegates to Congress and resident commissioners in this agreement shall not be construed to extend to any incorporated company where such contract or agreement is made for the general benefit of such incorporation or company. (Section 3741 Revised Statutes, and Sections 114-116, Act of March 4, 1909.)

/s/ Harry R. Woodward
State Forester

/s/ H. C. Hilton
Acting Regional Forester

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Wind Cave National Park
Hot Springs, South Dakota

April 8, 1948

MEMORANDUM OF UNDERSTANDING.

In accordance with Section 2 of Public Law 110-80th Congress known as the Forest Pest Control Act. The Forest Service and National Park Service have agreed to:

1. The Forest Service shall treat beetle infested trees upon lands embraced in the Jewel Cave National Monument, Wind Cave National Park and Mount Rushmore National Memorial with the full consent of the National Park Service.
2. Prior to actual treating work and in accordance with Standards agreed to in advance, insect infested trees shall be spotted for information of the treating crews by the Park Service.

/s/ Arthur L. Nelson
Arthur L. Nelson
Acting Regional Forester

/s/ Harry J. Lick
Harry J. Lick
Coordinating Superintendent

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MEMORANDUM FOR FILES

May 8, 1948

PAUL P. McCORD, Project Director

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COOPERATION - Black Hills I. C. Project
Golden Gate Timber Company

At the request of Forest Supervisor Hoffman, I contacted Mr. Estes, Superintendent of the Golden Gate Timber Company at Spearfish, on May 7, to discuss with him matters in connection with treating trees on property of the Homestake Mining Co. which are infested with the Black Hills bark beetles.

It has not as yet been possible for the Golden Gate Timber Company to do spotting on its property in the Bearlodge District. The spotting on their property in and adjacent to the main part of the Black Hills National Forest is nearly complete and to date, 442 trees have been spotted. Mr. Estes did not anticipate that many more trees would be found on these lands. Of the above number, 277 are merchantable, and Mr. Estes hopes to have them logged and sawn prior to the date of emergence of adult beetles. He plans also to fell trees below merchantable size in the same general location and yard these at the same time the merchantable trees are yarded. They will then be segregated from the merchantable trees and sprayed with ortho blend. Stumps on trees so handled will probably be treated by peeling. In case it is not possible to saw the merchantable logs by date of emergence, these also will be sprayed. Trees not treated as outlined above because of their isolated location will be sprayed standing except for occasional large trees which will be felled and sprayed.

All spotting in connection with infested trees on Homestake Mining Company holdings is being done by trained employees of the Golden Gate Timber Company. Labor in connection with treating will also be so handled.

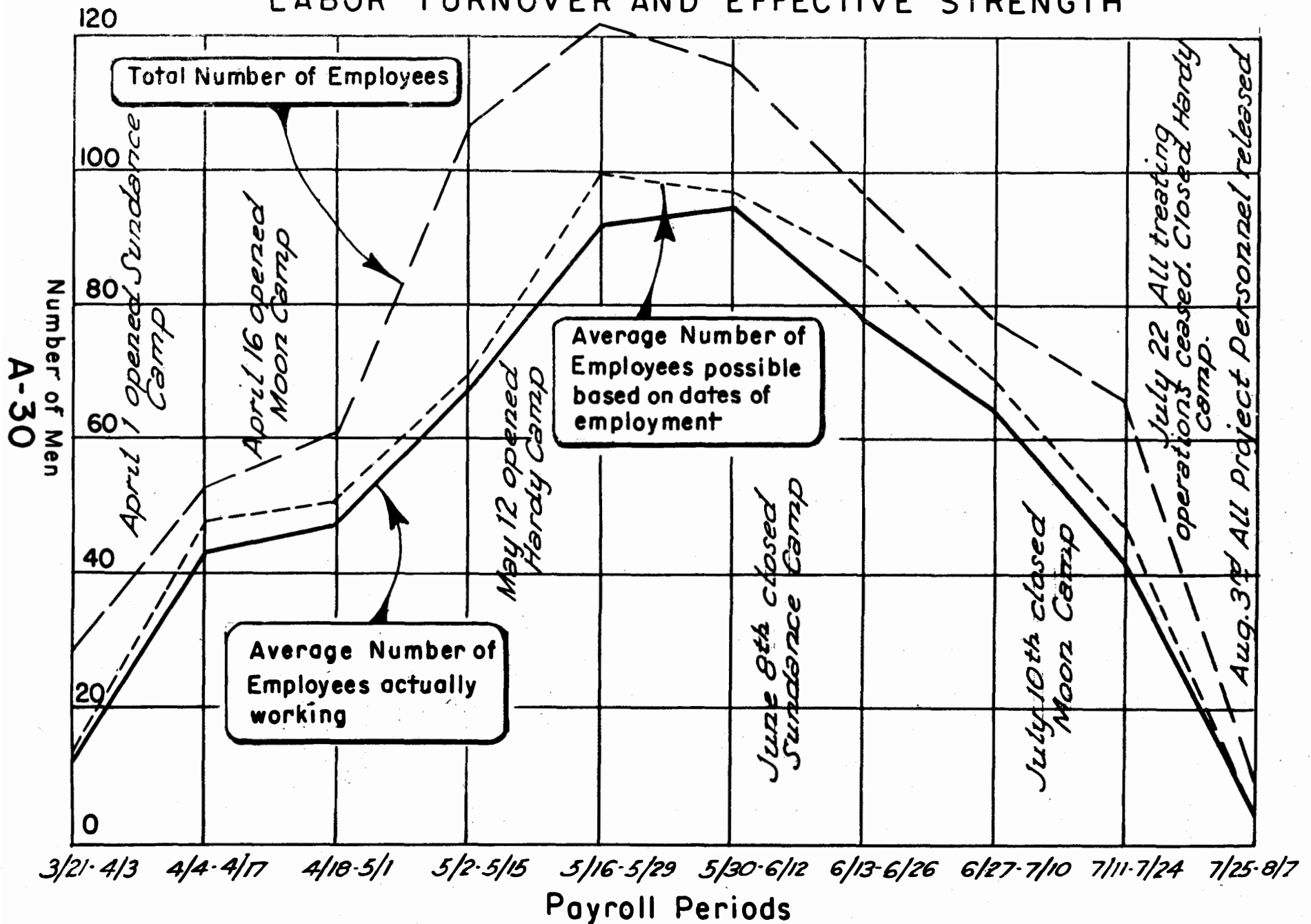
Since the insect epidemic on the Homestake Mining Company's lands threatens to spread to National Forest lands if not controlled, I agreed to furnish the necessary ortho blend for treating trees on Homestake Mining Company property in accordance with Mr. Granger's letter of May 3. I also agreed to loan Mr. Estes one hand sprayer and a number of jeep cans.

Mr. Estes desires to have the ortho blend delivered to storage at the Golden Gate Timber Company Sawmill at Spearfish and agreed to give me at least two days notice of the date on which he desired such delivery.

2 cc RO
cc Black Hills
Golden Gate Timber Company

Paul P. McCord

LABOR TURNOVER AND EFFECTIVE STRENGTH



LABOR SITUATION

Labor was not sufficiently plentiful to provide an opportunity for applying selectivity in employment but was sufficient to man the Project to estimated and actual required strength until the early part of July. At this time the approaching date for closing the Project caused many men to quit, with the result that clean-up work could not be pursued as rapidly as desired. From the quality of labor available, it was apparent that the local market could not have supported a project of any larger size.

With the exception of some Sioux Indians, no labor was imported from outside the immediate vicinity of the Project, although many of the laborers were "drifters" from all over the country.

Eighteen Sioux Indians were employed from the Pine Ridge Reservation. They were selected men and proved for the most part to be careful and dependable workers, especially on spotting. The worst criticism of them is that they began drifting away from the job long before its completion, and by the time the Moon Camp was closed on July 3, there were only 2 left; however, they did fill a gap in the labor situation that otherwise could not have been readily filled and saved the Project the expense of erecting camp facilities and operating a mess. They are sensitive and proud and require special handling by someone who understands them.

The camp overhead organizations were able to instill an amazingly high degree of interest in the work into the laborers on this job with the result that morale was generally high.

The services of U. S. Employment offices were found to be both friendly and effective in recruiting labor. It was not necessary to drop below the 18 year old standard, although a great number of apparently capable 16 and 17 year olds would have been available if needed, especially during the summer vacation period. Labor competition was at least normal with considerable road and utilities construction work in the area during the last $2\frac{1}{2}$ to 3 months of the Project. Publicity through the local newspaper appeared to be quite effective in recruiting labor; however, this publicity preceded the actual need for men by some 3 weeks, and although early applicants were advised as to probable starting date, many of them made several inquiries and finally obtained employment elsewhere.

Wage Rates

After surveying the going wage rates in the vicinity of the Project, a rate of \$8 per day for experienced, unskilled labor was recommended and approved. Strawboss rates of \$8.80, \$9.20, and \$10 per day were also approved. On the basis of estimate, it was agreed that \$2 per day worked would cover the cost of quarters and subsistence. This was handled by paying the base rate less \$2 per day worked rather than as

a payroll deduction. In other words, a laborer at \$8 per day who stayed in camp earned \$6 per day plus quarters and subsistence. No deduction was made for non-work days. There appeared to be both advantages and disadvantages to hiring on a wage plus subsistence basis. A great part of the difficulty was probably due to this Project more or less pioneering this procedure, at least so far as personnel and locality were concerned.

Terms of employment which varied from normal procedure were condensed and stamped on Forms 676. Meals were paid for on the basis of number ordered to avoid waste, especially on week-ends. In this respect it was necessary to request the men to advise as to meals they would not eat. This worked out satisfactorily and resulted in less than a 1 percent loss.

Partial days work and overtime were figured at gross pay less \$2 per day. Also, leave of any kind when employee was not at camp was paid at gross rate. Income tax deductions were based on total earnings including value of subsistence furnished.

Authority was secured to work 48 hours per week, and this proved to be a great help in obtaining and holding labor, as well as in obtaining progress on Project work.

Mess

The first mess contract to be let was at Sundance, Wyoming, and at the rate of \$.62 per meal. This contract was the basis for the \$2 per day subsistence deduction. Some 2 weeks later a second contract was let for the Moon Camp at the rate of \$.66 per meal. Both of these later proved to be too low, not allowing the contractor a reasonable margin of profit and resulting in questionable dependability, lower grade food, and dissatisfied men. The third contract was let 5 weeks after the first for the Hardy Camp at rates of \$.87 for breakfasts, \$1.02 for lunches, and \$1.12 for dinners. This contract, although higher, was very successful. The food was high in both quantity and quality which, undoubtedly, was a big factor in the successful retention of men. The contractor was very dependable, and relationship very satisfactory. It is believed the profit to the contractors was only fair, and the cost to the Government appreciably lower than would have been possible with a Government-operated mess.

Meal authorization sheets were used, which constituted a daily order signed by camp superintendent. These listed all men authorized to eat at the Government mess and provided for each man to sign for each meal taken. This sheet, in addition to being the basis for payment to contractor, provided a check against meals to unauthorized personnel, expense accounts of men on per diem, and time slips of per annum employees whose terms of employment necessitated meal deductions.

INFORMATION, RULES, AND REGULATIONS CONCERNING EMPLOYMENT ON THE
BLACK HILLS INSECT CONTROL PROJECT - 1948

1. Location of Camps - At Sundance, Wyoming; Hardy about 30 miles from Deadwood, South Dakota; and Moon, about 50 miles from Deadwood, South Dakota, and about 30 miles from Custer, South Dakota.
2. Transportation to Camp - Individuals or small groups of men may furnish their own transportation to camp. Groups of men hired at Project Headquarters in Deadwood, South Dakota, will be transported to the job. The Forest Service is under no obligation to return workers to point of hire if they quit or are discharged before the end of the job.
3. Who May be Employed - Employment is open to any able bodied man who has reached his 18th birthday. In case men above this age are not available, 17-year old boys, well developed and physically able to handle the work involved, may be hired.
4. Period of Employment - Work will begin about the middle of April and will be over between July 1 and July 15.
5. Pay Rates and Hours of Work - The beginning pay is at the rate of \$8 per day when actually worked. Upon demonstration of their reliability and ability to handle small crews of men, some men may be advanced to pay rates between \$8.80 and \$10 a day. The work week is six days of 8 hours per day. Time in excess of 40 hours per week will be paid for at time and one-half. A full day's work shall consist of 8 hours actual work, except that time going to and returning from the job in excess of a total of 1 hour will be included in the work hours. If weather or other conditions make it necessary, in the judgment of the Forest Officer in charge, to work less than 8 hours in any day, the pay will be in proportion.

Payroll periods are 2 weeks in duration ending April 3, April 17, May 1, etc. Checks will be received in about 10 days to 2 weeks from the end of the pay period. Men quitting the job will not be paid until the regular payroll.

6. Mess and Quarters - Government mess, quarters, beds, and bedding are available for which a deduction of \$2 will be made for each work day or partial work day.
7. What to Bring to Camp - Toilet articles, work gloves, heavy shoes (preferably with rubber soles), and work clothes. The weather will be cool enough to necessitate wool shirts and jackets. Labor on the job cannot be performed by men improperly clothed.
8. Camp Sanitation - No refuse, wash water, or rubbish will be thrown in or near streams. Latrines will be provided and must be used by men when in camp.
9. Personal Conduct in Camp - No gambling, drunkenness, or intoxicating liquor will be allowed in camp. For further information contact Project Director, Black Hills Insect Control Project, U.S. Forest Service, Deadwood, South Dakota.

TREATING EQUIPMENT

The treating equipment used on the Project was, for the most part, modifications of commercial products. The equipment can be classified as consisting of 2 main types: (1) portable and (2) automotive mounted power equipment. The portable types can be classified into those driven by gasoline engine and those operated manually.

A general description of the power pumps follows:

1. Geroter Treating Outfit

Pump

The pump is of an oil type and is manufactured by the Geroter May Co. of Baltimore, Maryland. It is designed to operate at pressures up to 1,000 lbs. per square inch. The delivery rate is approximately 2 gals. per minute at 3,000 R.P.M. It is of the type designed by the Geroter May Corporation as B 1.5. It has $\frac{1}{2}$ " intake and discharge and is so constructed as to run in a clock-wise direction. The pump is driven directly from the drive shaft of the engine to which it is attached by a flexible coupling.

Engine

The pump is powered by a 4 cycle Briggs and Stratton gasoline engine which is rated at 1.30 H.P. at 2,600 RPM, 1.60 H.P. at 3,300 RPM, and 1.68 H.P. at 3,600 RPM.

Insecticidal Mixture Tank

The tank for the machine was made from a jeep can. The tank outlet is located at the bottom and is directly connected to the intake of the pump with $\frac{1}{2}$ " brass tubing. A filter screen made of carburetor screen was built into the intake tubing.

Frame

The frame was made of $\frac{3}{4}$ " thin walled conduit.

Discharge Equipment

40 feet of $1\frac{1}{4}$ " - $\frac{3}{8}$ " neoprene high pressure hose. To this was attached an 8-ft. bamboo extension manufactured by the Hudson Manufacturing Co. The bamboo extension was equipped with a $\frac{1}{4}$ " gate valve. The nozzles used were of 2 types. The nozzle blanks for both types were obtained from the Dobbins Manufacturing Co. of Elkhart, Indiana. Both types were drilled to a $\frac{3}{32}$ opening (No. 6). One type, however, was fitted with a screw cap drilled to a $\frac{5}{64}$ " opening (No. 5) so that the size of the spray stream could be reduced when desired. The bore on this type was finished to commercial smoothness. The bore on the other type was finished to gun bore smoothness.

The Geroter pump was so constructed that it could be lifted intact from the carrying frame and mounted on automotive equipment with a larger carrying capacity of insecticidal material.

2. Oberdorfer Treating Outfit

This power pump developed in Region 4 in connection with the Targhee-Teton Project was also used on the Black Hills Project. The following description of this machine is taken from an unpublished report of the Forest Insect Laboratory of Coeur d'Alene, Idaho. (See Fig. 1).

Frame

Constructed of 3/4" conduit with welded joints. The handles are constructed so as to permit the men carrying the machine to walk at its side, each man supporting the machine with one hand.

Pump

Oberdorfer gear type with built in relief valve. 1/2" discharge and intake.

Engine

The pump is powered with a 1 1/2 H.P. 4 cycle Lawson gasoline engine. Weight 33 pounds.

Discharge

The hose used on this piece of equipment was 1/4" - 3/8" neoprene high pressure hose. The extension consisted of a 9' section of steel tubing fitted with a 1/4" shut-off valve.

Insecticidal Mixture Tank

Similar to the tank described for the Geroter type sprayer.

3. Manually Operated Pumps

The manually-operated pumps are modifications of the Dobbins No. 3171 wheelbarrow sprayer and the Myers wheelbarrow sprayer Model No. 336 1/2 B. Both pieces of equipment were mounted in a 12-gallon galvanized can equipped with carrying handles, one in front and two in the rear. The handles are made of 3/4" black iron conduit.

The 3171 model was equipped with a pressure tank furnished with a pressure gauge. This pressure tank is built to withstand pressures up to 300 lbs. per square inch. Its delivery rate varies as to pressure. At a pressure of 75 lbs. the delivery rate is 1 1/2 gals. per minute. (See Fig. 2).



Figure 1. Oberdorfer portable power pump. Insecticidal mixture tank is being refilled through use of continuous flow oil pump.



Figure 2. Treating with Dobbins hand pump. Nozzle-man is using 8-foot bamboo extension.

The ~~Myers~~ pump is similar in construction to the Dobbins except for size. It is somewhat heavier, and because of the large air chamber built into the pump, an air pressure tank is not necessary to maintain even pressures. The delivery rate of this pump is approximately 3 gals. per minute at 75 lbs. pressure.

The discharge equipment is similar to that described for the portable power sprayers.

4. Automotive Mounted Power Equipment

The non-portable equipment used on the Project was of 2 types, both of which are manufactured by the Bean Cutler Division of the Food Machinery Corporation. One type was mounted on the Universal Jeep; the other type on the Dodge Power Wagon.

The type mounted on the Universal Jeep has the following specifications:

Sprayer Model No.	4700 MT
Pump, Model No.	64
Capacity gallons per minute	4
Maximum pressure, lb. per sq. in.	400
Engine	Briggs Stratton $4\frac{1}{2}$ H.P.
Drive	Belt
Tank	50 gal.
Overall length	45- $\frac{7}{8}$ "
Overall width	31- $\frac{1}{2}$ "
Overall height	25"
Weight	325 lbs.

The discharge equipment consisted of a live reel which held 500 feet of high pressure neoprene hose with an inside diameter of $\frac{3}{8}$ of an inch. The spray gun used was the Bean Spraymaster equipped with No. 7 and No. 8 discs. (See Fig. 3).

The equipment on the power wagons was similar in all respects to the equipment mounted on the Universal Jeeps except for the 100-gallon tank and the engine and pump being mounted on top of the flat tank. The power wagons were equipped with four 55-gallon drums, which allowed them to carry upward of 300 gallons of insecticidal material in one load. (See Fig. 4).

Both types of equipment were equipped with injector type refillers with a capacity of 20 gallons per minute. Where the injector refillers were not available, continuous flow, hand-operated, oil barrel pumps were substituted.

INSECTICIDAL MIXTURES

Orthodichlorobenzene, 1-6 in fuel oil, and benzene hexachloride, .5 and .25 percent gamma isomer, were equally effective in destroying broods of Black Hills beetle. Approximately 35,000 trees were treated with orthodichlorobenzene mixture, and 10,000 with benzene hexachloride mixture. Initial treatment with benzene hexachloride was

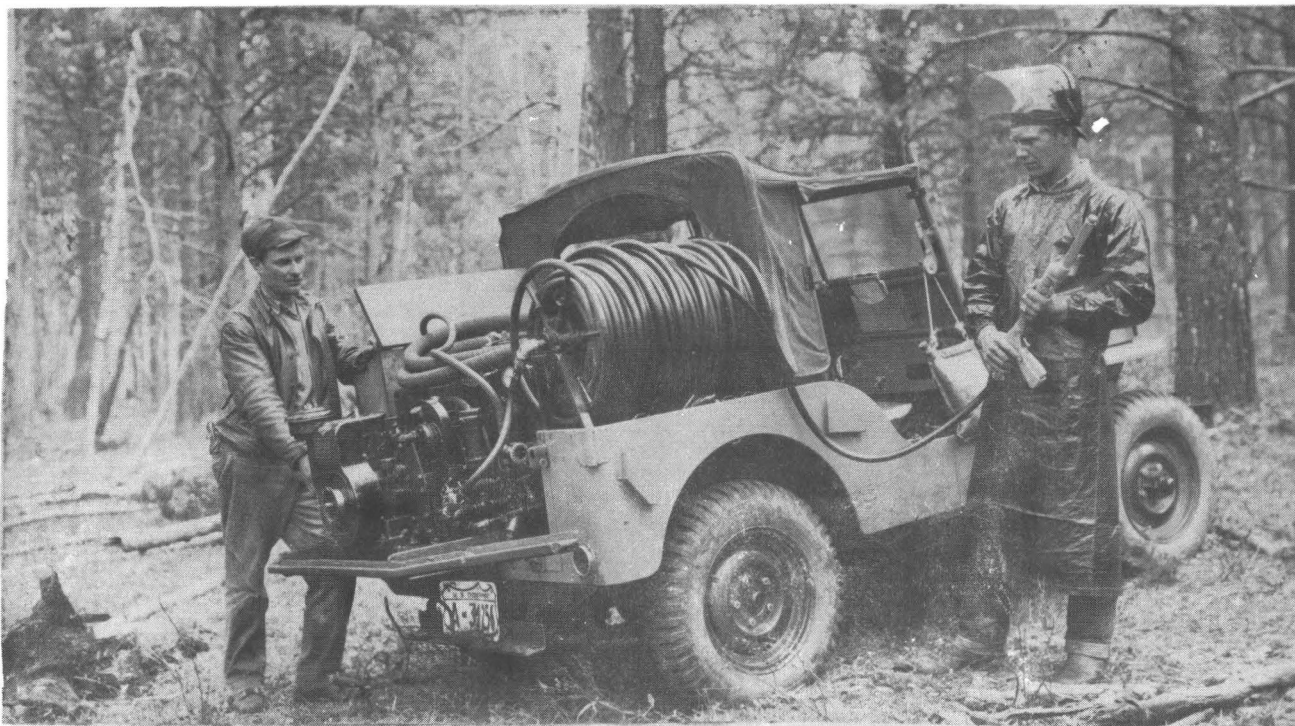


Figure 3. Universal jeep on which is mounted Bean agricultural sprayer and live reel containing 500 feet of 3/8" neoprene hose. Note guard made from light mine rail and mounted at rear to protect pump equipment from injury when backing. Nozzleman is wearing neoprene apron and a helmet with shield in raised position. He holds a Bean spray-master spray gun.



Figure 4. Dodge power wagon on which is mounted Bean fog pump and live reel containing 500 feet of 3/8" neoprene hose. A continuous flow oil pump is attached to one of the four 55-gallon drums used as auxiliary insecticidal mixture tanks. Note the removable safety ladder hooked over tail gate.

with the .5 percent gamma isomer, and approximately 7,000 trees were treated with this dosage. About 3,000 trees were treated with .25 percent gamma isomer of benzene hexachloride. Subsequent examination proved it equally effective with the higher percentage of the gamma isomer of benzene hexachloride.

The benzene hexachloride was obtained from the Pennsylvania Salt Company. The material containing 36 percent gamma isomer was in a hard waxlike form when received from the company and was quite difficult and expensive to dissolve. It was necessary to raise the temperature of the oil by heating in an oil still to completely dissolve the benzene hexachloride.

Benzene hexachloride mixture also proved to be more difficult to use than orthodichlorobenzene mixture in that it was more irritating to the skin of the nozzlemen, and on especially warm days some of the crew men broke out in a rash as the result of the mixture coming in contact with the skin.

Orthodichlorobenzene was mixed and stored in bulk at the Carter Oil Company refinery at Newcastle, Wyoming. Tentative arrangements were made with this concern to furnish a 41,000 gallon storage tank in which No. 2 burner fuel and orthodichlorobenzene would be placed in correct proportion and mixed by the company. These arrangements were later confirmed by a contract with the Carter Oil Company, which was the successful bidder on furnishing the burner fuel. Orthodichlorobenzene was purchased in tank-car lots at a considerable saving in cost.

Benzene hexachloride was mixed and stored in bulk at the Crook County refinery at Sundance, Wyoming, which was the successful bidder on furnishing burner fuel for a portion of the Project. Satisfactory arrangements were made with this company to heat the burner fuel for mixing.

Orthodichlorobenzene @ \$.0675 per lb. f.o.b. Newcastle, Wyoming.
No. 2 burner fuel @ \$.15 per gallon at Newcastle, Wyoming.
Mixing and storing at refinery @ \$.02 per gallon.
Total cost of \$72 for labor and transportation of orthodichlorobenzene from tank car to refinery. Orthodichlorobenzene mixture cost about \$.25 per gallon based on the above unit costs.

Benzene hexachloride mixture cost about \$.325 per gallon based on the following costs:

Benzene hexachloride @ \$1.1475 per lb. f.o.b. Sundance, Wyoming.
No. 2 burner fuel @ \$.175 per gallon at Sundance, Wyoming.
Mixing Costs:
Supervision and labor - \$39
Costs at refinery - pumping, heating, etc. - \$340.

Arrangements were made to borrow three 660-gallon 6x6 GMC oil tankers from the Air Forces at Weaver Field, South Dakota. These were used to transport insecticidal mixtures from storage at Newcastle and Sundance to supply points in the woods. Insecticidal mixtures were transferred from these tankers to storage in tanks or oil drums in the woods, direct to treating equipment or to small tanks or oil drums mounted on power wagons for further transportation to the scene of treating operations. This phase of an operation, such as this project, is of paramount importance and must be adequately provided for. (See Fig. 5).

COMPARATIVE COST OF TREATING BY VARIOUS TYPES OF EQUIPMENT

A study conducted with a Bean agricultural pump, a portable power pump, and a hand pump, where each type of equipment was operating under comparable conditions, gave the following results:

Universal Jeep	21 trees per man day
Portable Power Pump	18 trees per man day
Hand Pump (Dobbins)	20 trees per man day.

AUTOMOTIVE EQUIPMENT

The following automotive equipment was used on the Project:

<u>Type</u>	<u>Number</u>	<u>Use</u>
1½ T Stake Trucks	5	General hauling.
½ T Pickups	4	Camp Superintendents and general use.
Air Force GMC 6x6 Oil Tanker	3	Transporting insecticidal mixtures.
Dodge Power Wagon	14	Mounting Bean Fog Pumps, carrying personnel, and transporting insecticidal mixtures.
1 T Jeep Trucks	10	Personnel carriers and transporting insecticidal mixtures.
Sedan	1	Project Director's Office
Army Jeeps	17	Personnel carriers for superintendents and for hand treating operations.
Universal Jeeps	4	Mounting Bean agricultural sprayers.

For the most part, this equipment was used without modification other than mounting the power treating equipment. On power wagons and Universal Jeeps so used, it was necessary to move the muffler and exhaust from underneath the equipment to the running board of the power wagon and to the front bumper of the Universal Jeep. This was done to eliminate the fire hazard resulting from dripping of the inflammable insecticidal mixtures.



Figure 5. U.S. Air Force 660-gallon 6x6 G.M.C. oil tanker which was used to transport insecticidal mixtures.

The spare tire carrier on the Universal Jeep was mounted on top of the hood to cut down width. Steps were also removed for the same purpose.

All power wagons used for mounting power treating equipment were equipped with a power winch on the front end. This was very useful in getting equipment in and out of difficult spots.

The jeep trucks are 7 inches wider on the rear wheels than in front. This proved to be a distinct disadvantage when driving in the timber, since the rear fenders catch on objects easily passed by the front end.

4-wheel drive equipment was essential to the Project because of the mud conditions, and in order to gain access to difficult terrain. It had its disadvantage in that drivers had a tendency to believe it could go anywhere, and constant vigilance was required to prevent abuse. Hard use of automotive equipment is unavoidable on a project of this nature, and some fenders, tail lights, and running boards were damaged; otherwise, equipment came through in good shape.

TOPOGRAPHY

Topography in which project work was accomplished was an important feature in planning. The major portion of the infestation occurred on the western half of both Forests where the terrain varies from flat or gently rolling tableland to very steep slopes and rocky canyons. It was largely accessible to 4-wheel drive motor equipment. Slopes are ordinarily not long, and the construction of a few miles of spur roads in rough terrain brought most of the infested trees within reach of this equipment. Over much of the area, existing roads and trails gave sufficient access, and the only road work necessary was the clearing of winding trails through the timber. Since, as a matter of expediency to complete control operations, hand sprayers were used in some areas which would have been accessible to automotive-mounted equipment, it is impossible to state exactly what percentage of the trees could have been treated with automotive-mounted equipment, but it is believed this can be conservatively stated as at least 95 percent.

WEATHER

A late spring caused late melt of snow which retarded natural opening of roads. Snow in the timber slowed early spotting operations and made it impossible to get spraying equipment into the timber as early as was desired. After the snow melted, the roads were very muddy for a time; however, by early May, all roads were in passable condition, and good weather was experienced most of the time until early June, when rainy weather set in. From June 10 to nearly the end of the month, there was not a day without rain, and efficiency was greatly reduced. For the remainder of the Project, fair weather prevailed, although rains prevented treating on several days in July.

RELATION OF THE PROJECT TO THE FORESTS

This Project was handled as a Regional Office Project under a Project Director, who, while operating independently of the 2 Forest Supervisors involved, worked in close coordination with each of them and their organizations.

Insect control work was primarily handled directly under the Project Director. On the Harney - other work area - it was handled by Harney fire suppression crews working under the direct supervision of the Harney organization. The Black Hills - other and Spearfish work area - was handled by fire suppression crews under District Rangers working directly under the Project Director. Rangers gave invaluable aid in locating infested areas and furnishing information regarding existing roads and good locations for spur roads to be built for Project purposes. Rangers obtained all cooperative agreements for work on private lands.

Fire control. By agreement with the 2 Forest Supervisors, Project crews were to take immediate action on fires in their immediate vicinity. For all other fires they were to be used only as a last resort. They were to be relieved on all fires as soon as possible. Fortunately, the fire season was such that it was necessary to use Project crews on only 2 fires. The difficulties arising out of differences in wage rates and interference with Project work made it very important that use of insect control Project crews for fire control be held to a minimum.

ACCURACY OF 1947 FALL SURVEY

The systematic survey on the Black Hills proved to be reasonably accurate as to total number of trees, since a total of about 36,340 was treated on National Forest land and private lands inside the boundary as compared with the estimated 39,250. Since records of Project accomplishments were not maintained by Ranger Districts, it is not possible to compare the accuracy of the survey in that manner; however, experience in organizing the Project indicated that a survey of the type described by Ginter is principally valuable to determine the overall size of the Project, and neither is it accurate as to size of individual concentration nor does it give sufficient information as to geographical location of infestations. Many areas of infestation, some of them fairly large, were found which were not indicated in the survey. It is believed that the expense and time involved in a more intensive survey and map on at least a 2" to 1 mile scale would pay dividends both in more accurately determining the size of the job to be done and as an administrative tool in planning and organizing control work.

The Harney estimate was quite low, since a total of 12,700 trees was treated as compared to the estimate of 7,700 trees. This again emphasizes the desirability of intensive surveys in advance of control.

One of the greatest handicaps in administering this Project was the lack of accurate knowledge as to the location, size, and degree of infestations. An attempt was made to overcome this handicap by ground reconnaissance in advance of spotting. This was expensive and time consuming, and the results obtained were disappointing.

TRAINING

On-the-job training was used exclusively, there being neither time nor opportunity to do classroom training. Key men were changed so frequently, as the Project developed, that they had to be trained on the job when available.

The general procedure was to use the more experienced key men to train those less experienced, with guidance and supervision from the Bureau of Entomology and Plant Quarantine representative and the Project Director's office. Camp superintendents were directly responsible for training in their respective camps. They were assisted by the chief spotting foreman and chief treating foreman.

Trained key men carried the training to spotting and treating crews on the job. The effectiveness of this training was constantly checked through inspection by the camp superintendent and his staff, the representative of the Bureau of Entomology and Plant Quarantine, and the Project Director's office.

Form 675-R-2
April 1948

UNITED STATES DEPARTMENT OF AGRICULTURE
Forest Service, Region 2

(Forest)

(Place)

(Date)

M

(Full name, incl. middle initial)

(Address)

You are hereby appointed to the following position, subject to your acceptance by execution of "Conditions of Employment" on reverse side of this form:

Position: _____
(Payroll title) (Grade)

Salary: \$ _____ per _____ when actually employed

National Forest

* Subsistence and lodging valued at \$2.00 per day furnished by Government.
Effective _____ for the duration of the
work to which assigned unless sooner terminated.

A deduction at standard rates will be made from your salary if Government subsistence or quarters are furnished.

(I certify that no higher priority applications are on file from individuals qualified and available for this position.)

For the purpose of annual leave taken during period of hire, annual leave covered by lump sum payment, sick leave and overtime work, the gross daily wage of

(Administrative Officer)

\$ _____ less applicable subsistence deduction will be used.

(Title)

The above employment was terminated on _____,
19____, at the close of business (full work day covered
_____ hours), because of:

(Resignation, completion of work, transfer to, etc.)

Services rated as _____

(Administrative Officer)

(Date signed)

(Title)

Check or complete
each item

Letter of Authority or
Schedule A authority

30-days
120-days
180-days
6 months
10 months (LDR)
11 months (Unsk. Lab.)

Project, District, or
Lookout Station to which
assigned:

Appropriation:

Form W-4 submitted:

19____

Race:

White
Yellow
Red
Negro
Brown

Veteran? Yes No

World War I II ?

Basis of preference:

5 pt.
10 pt.

Wife of disabled veteran
or widow of veteran

Date of enlistment:

Date of discharge:

Rank and organization:

War disability
received \$

Emergency Officer's retired
pay received \$

LP = Lodgepole LbP = Limber Pine PP = Ponderosa Pine

NATIONAL FOREST _____ RANGER DISTRICT _____

DATE SPOTTED _____ CONTROL FOREMAN _____

SEC. _____ T. _____, R. _____, _____ P.M. ALIENATED LAND _____

SPOTTING RECORD	CONTROL RECORD
-----------------	----------------

DRAWN: I.Q.T. 1938

S
CONTROL - Black Hills Insect Control Project
Insect

1948

(Date)

(Unit or Camp)

CUMULATIVE WEEKLY REPORT

Period of Report _____ thru _____ 1948

National Forest / Private Land
(Cross out one)

Estimated No. Trees in Unit _____

SPOTTING

TREATING

	: No. of trees:		Number of Trees		
Prev. Reported:	:	Type of Treatment	:Prev.:	This:	To-
This Period	:		:Rep.	:Per.:	tal
Total to date	:	Sprayed Standing (P.W.)	:	:	:
	:	Sprayed Standing (Jeep)	:	:	:
Trees per man day:	:	Sprayed Standing (Port.P.S.)	:	:	:
Previous Report	:	Sprayed Standing (Hand Pump)	:	:	:
This Period	:	Felled and Sprayed	:	:	:
Average to date	:	TOTAL TREES TREATED	:	:	:
	:	Trees per man day	:	:	:
		Average to date			

COST RECORD

ITEM	: SPOTTING:	:	: TREATING	:	:
	:	P. Wagons:	U. Jeep:	Port. Power:	Hand: Total
Labor	:	:	:	:	:
Subsistence and Quarters	:	:	:	:	:
Materials	:	:	:	:	:
Equipment Use	:	:	:	:	:
Other	:	:	:	:	:
Total Costs This Period	:	:	:	:	:
Total Costs Previous Report:	:	:	:	:	:
TOTAL Costs to Date	:	:	:	:	:
Man days this period	:	:	:	:	:
Man days to date	:	:	:	:	:

PER TREE COSTS

:	: This Period:	To Date:
: Spotting Cost	:	:
: Treating Cost	:	:

Detailed costs as shown on the reverse of this form.

REMARKS:

SIGNED _____

Worksheet for report to be made on reverse hereof.

LABOR

Supervisory (Chargeable to RPSA)

Employee	Title	P/A Salary	Gross Cost Spotting	This Period Treating

OTHER LABOR

man days spotting and	man days treating	@ \$	6.00	
" "	" "	@ \$	8.00	
" "	" "	@ \$	6.80	
" "	" "	@ \$	8.80	
" "	" "	@ \$	7.20	
" "	" "	@ \$	9.20	
" "	" "	@ \$	10.00	
" "	" "	@ \$	12.00	
" "	" "	@ \$	11.20	
" "	" "	@ \$	13.20	
" "	" "	@ \$	11.80	
" "	" "	@ \$	13.80	
" "	" "	@ \$	13.00	
" "	" "	@ \$	15.00	
" "	" "	@		
" "	" "	@		

TOTAL LABOR \$ _____ \$ _____

SUBSISTENCE

Meals @ \$	_____
Food Purchased	_____
Kitchen Salaries	_____
Laundry	_____
Utilities & Other	_____
TOTAL SUBSISTENCE	# _____
Total subsistence costs for spotting	_____
" " " " treating	_____

#(To be prorated on the basis of labor costs above.)

MATERIAL

Spot. Treat.

Gal. Ortho blend @ 25¢	XXX	_____
Gal. Benzene Blend @ 32 ¹ / ₂ ¢	XXX	_____
Other (Itemize)		_____

TOTAL MATERIAL		_____

OTHER (Itemize) Spotting Treating

EQUIPMENT USE COSTS

Miles Sedans @ .0575	_____
Miles 1 ¹ / ₂ T PU's, Panels, 1 ¹ / ₄ T Jeeps @ .065	_____
Miles 1 ¹ / ₂ T stakes, 1T Jeeps & P.W. @ .1075	_____
Miles 2 ¹ / ₂ T GMC Tankers @ 0.12	_____
Hrs. D-4 Cat @ \$2.50	_____
Hrs. D-7 Cat @ \$3.70	_____
Hrs. Motor Patrol @ \$3.60	_____

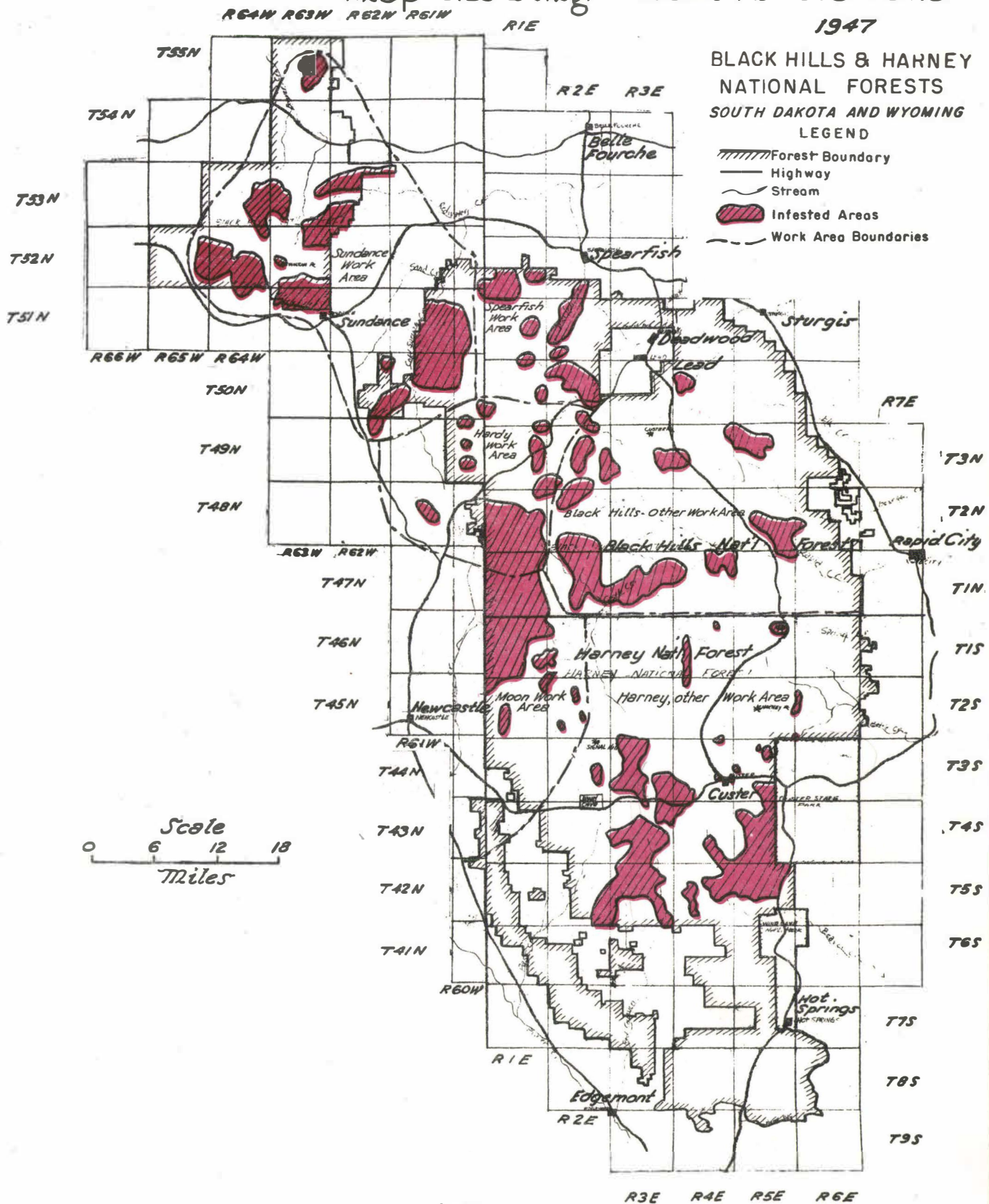
TOTAL EQUIPMENT COSTS

Total Equipment Costs for Spotting

Total Equipment Costs for Treating

Prorated as to reporting officer's best estimate.

Map showing Probable Infestation



Map showing Areas treated

